Heating Piping & Air Conditioning

NOVEMBER 1955

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INDUSTRIAL • COMMERCIAL • INSTITUTIONAL • PUBLIC BUILDINGS

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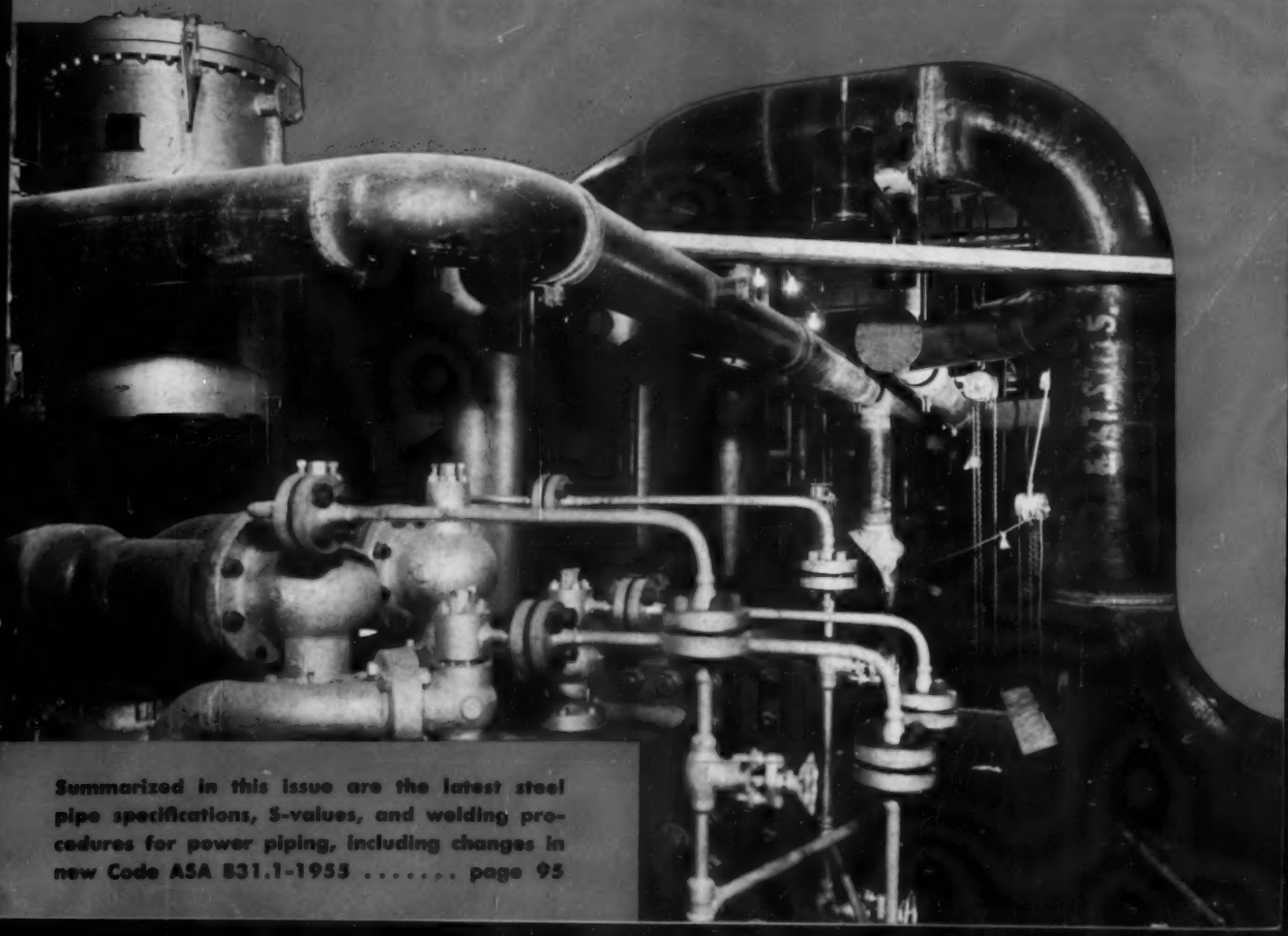
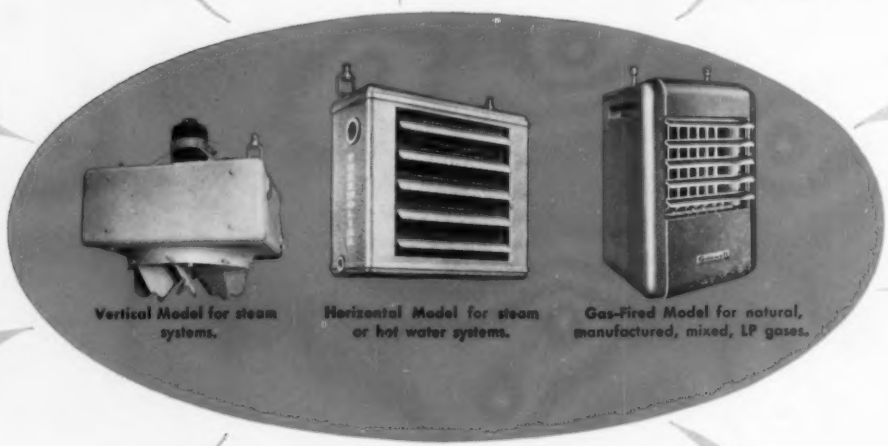


Summarized in this issue are the latest steel pipe specifications, S-values, and welding procedures for power piping, including changes in new Code ASA B31.1-1955 ..... page 95

GRINNELL UNIT HEATERS

...for MAXIMUM comfort, economy, and flexibility

Grinnell Unit Heaters bring you many unique design and construction features, coupled with important advantages in comfort, economy, and ease of heating. Heat comes fast, even from a cold start — and is spread uniformly to all parts of the working area. It is not allowed to bank up uselessly under the ceiling. Units are compact. And, both unit and the simple piping are overhead, out of the way, easy to relocate if necessary. Heating capacity often exceeds that of other types costing twice as much.



Vertical Model for steam systems.

Horizontal Model for steam or hot water systems.

Gas-Fired Model for natural, manufactured, mixed, LP gases.

GRINNELL THERMOLIER
Steam/Hot Water Unit Heater
4 models . . . 18 sizes — from 35,600 to 275,300 total heat delivered, Btu per hour

Three basic models—horizontal, vertical, and a special horizontal Textile model. (Adjustable velocity nozzle also available for use on horizontal models.) All models have plain thermostatic trap, the simplest and least expensive kind of a trap, made practical because of unit's exclusive internal cooling leg; maximum capacity provided and destructive water hammer eliminated by built-in pitch of tubes. Many other important features.

GRINNELL
Gas-Fired Unit Heater
Available in 7 sizes — ranging from 25,000 to 200,000 Btu per hour input

Grinnell Gas-Fired Unit Heaters are easy to install, simple to operate and maintain. Efficient performance is assured — with any type of gas — by modern design of burners and heat exchanger, proper motor and fan unit. Automatic safety pilot operates to shut off main gas supply if pilot goes out. Flashback and extinction noise prevented by the burners' raised port design and proper port size for the gas used. American Gas Association approved.

Grinnell Unit Heaters are backed by over 60 years of heating experience, and proved by trouble-free service in countless installations. They are distributed by a coast-to-coast network of plumbing and heating jobbers . . . and in over 30 principal cities, Grinnell engineers can offer on-the-spot advice and help on your heating problems. For new buildings, or for modernizing existing heating systems, it makes good sense to call on Grinnell first — for the unit heater that will meet your specific needs.

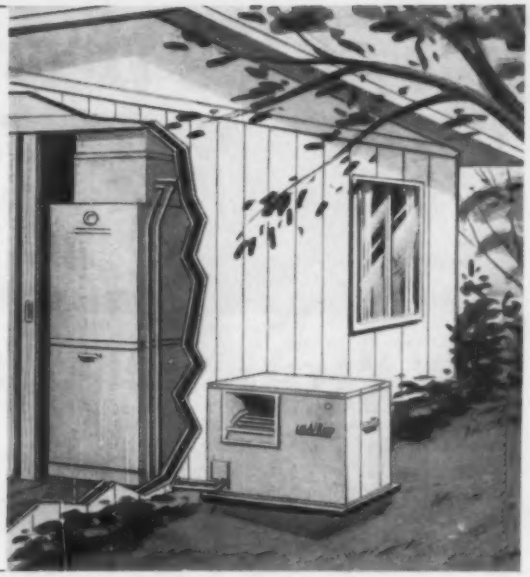
AVAILABLE FROM YOUR LOCAL DISTRIBUTOR.

Grinnell Company, Inc., Providence, Rhode Island

Manufacturer of: pipe fittings • welding fittings • forged steel flanges • steel nipples • engineered pipe hangers and supports Thermolier unit heaters • Grinnell-Saunders diaphragm valves • prefabricated piping • Grinnell automatic fire protection systems

in tremendous demand
for home and business

usAIRco *Kooler-aire system for "waterless" air conditioning*

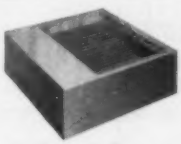


The industry's most complete line of "air-cooled"... in matched 2, 3, 5 & 7½ h.p. models!

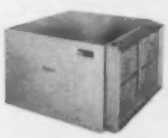
CONDENSING UNIT
compressor, condenser coil, blower, receiver

HORIZONTAL AIRFLOW COOLING COIL
coil, expansion valve, drain pan

VERTICAL AIRFLOW HOUSED COIL
v-type coil, expansion valve, drain pan



COUNTER FLOW HOUSED COIL
coil, expansion valve, drain pan



COIL-BLOWER HOUSED SETS
filter, coil expansion valve, drain pan, blower.

usAIRco
50 YEARS OF AIR CONDITIONING

UNITED STATES AIR CONDITIONING CORPORATION
Minneapolis 14, Minnesota
Export: 13 E. 40th Street, New York 16, N.Y., U.S.A.

Meet today's growing demand for waterless air conditioning with the most efficient equipment built . . . usAIRco Kooler-aire. Kooler-aire operates on electricity only, ideal where water is scarce or expensive, and where water disposal is a problem. The condensing unit is usually located out-of-doors, but may be installed indoors when vented. Cabinet is weatherproof. Copper tubing carries the refrigerant from the condensing unit to the Kooler-aire coil, which may be installed anywhere on the outlet side of the air supply system. Where an independent blower system is needed, usAIRco provides a housed coil-blower unit with optional filter section.

RESIDENTIAL | COMMERCIAL | INDUSTRIAL

Year 'Round | Add-on | "Packaged" | Central Station Air Conditioner

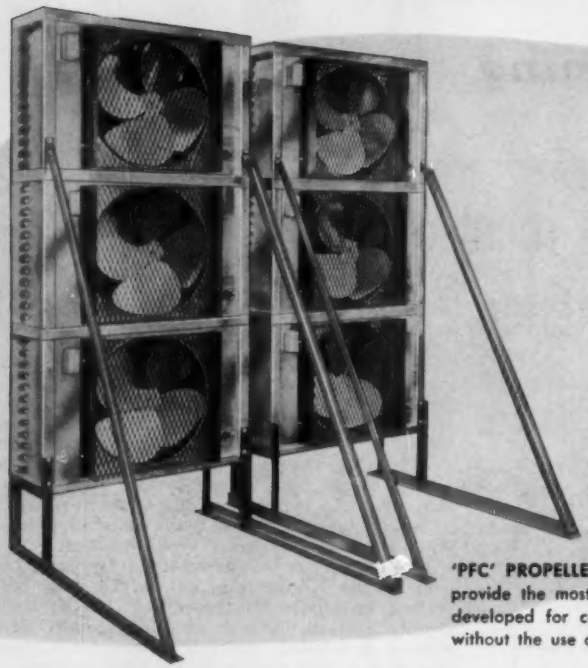
See our exhibit at booth 531

Two of the New

BOOTHS 323-4-5-6

INNER-FIN UNITS

you'll see at the Bush Booth!



'JF' JET-FLO UNIT COOLERS feature gleaming, hospital-clean stainless steel cases . . . completely non-ferrous construction.

'PFC' PROPELLER-FAN CONDENSERS provide the most practical method yet developed for condensing refrigerants without the use of water.

You'll want to have a good look at these latest additions to the complete BUSH line. Both incorporate famed Inner-Fin® coil construction . . . patented BUSH development that's revolutionized design of air conditioning and refrigeration units.

Some of the other BUSH units you'll want to see: 'CRH' REMOTE AIR CONDITIONERS for ceiling mounting. Used in hotels, motels, etc. . . . wherever wall and floor space is at a premium.

LOW TEMPERATURE UNITS: **'HG' Hot Gas Defrost and 'ED' Electric Defrost Unit Coolers.** An operating demonstrator will let you see for yourself the superior operating efficiency of these new sensations of the low temperature field.

'GD' Glycol Defrost Product Cooler in simulated operation.

INNER-FIN EVAPORATIVE CONDENSERS AND COOLING TOWERS • INNER-FIN AIR CONDITIONING COILS • MULTIZONE UNIT • UNDER-THE-WINDOW AIR CONDITIONING UNITS • UNIT COOLERS

BUSH

Be sure to see the industry's most complete line . . . at the Bush booth #323, 4, 5, 6.

BUSH MANUFACTURING COMPANY • West Hartford 10, Connecticut

RIVERSIDE • CALIFORNIA

Heating Piping & Air Conditioning

Vol. 27 No. 11

(with which is merged the Aerologist)

DESIGN, INSTALLATION, OPERATION AND MAINTENANCE IN INDUSTRIAL, COMMERCIAL, INSTITUTIONAL AND PUBLIC BUILDINGS

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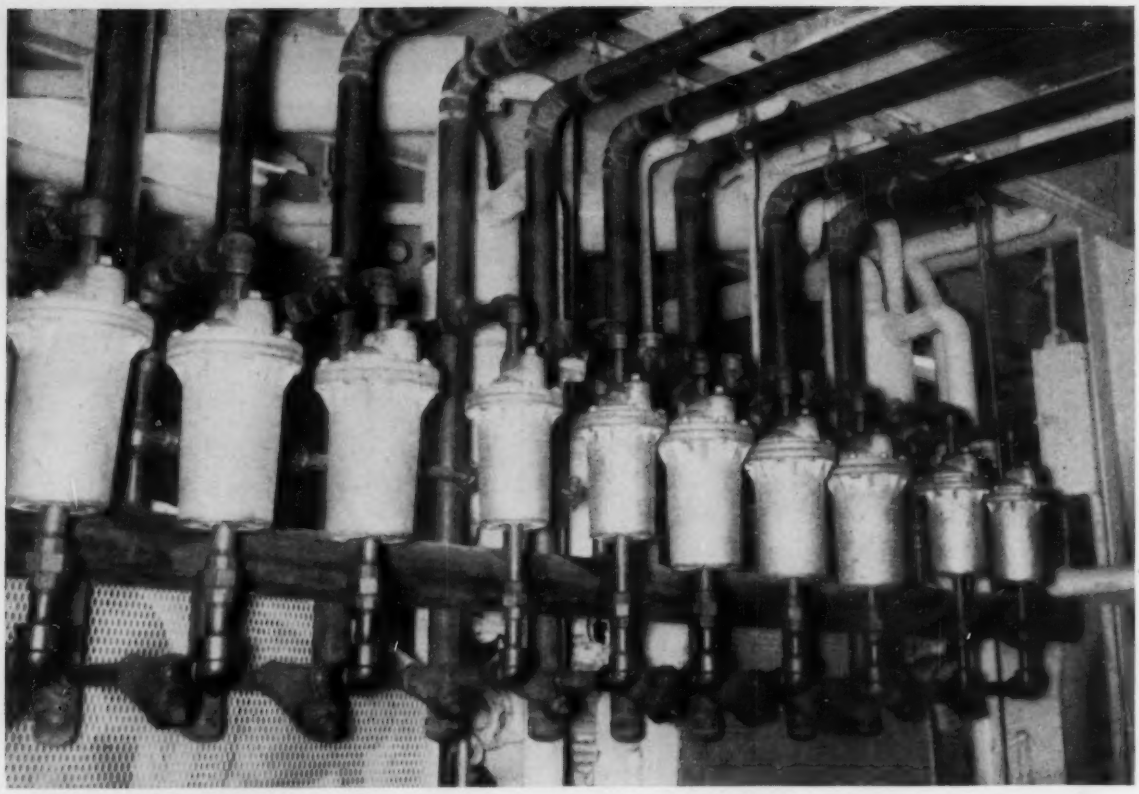


Tip on Choosing Steam Traps: Run Tests with a Pyrometer

Bottom inlet-top outlet traps in six sizes, ½" to 2" connections; 950 to 20,000 lbs/hr capacity.

Side inlet-side outlet traps in five sizes, ½" to 1¼" connections; 680 to 6700 lbs/hr capacity.

Integral strainer traps in three sizes, ½" and ¾". Cost less than trap and separate strainer, save fittings and labor.

A common problem—Traps on Rogers spray driers at Rochester Dairy Company, Rochester, Minn., required frequent servicing—used up about two months of one man's time annually. And, then, within about 30 days after trap servicing, drier temperatures would be 100 degrees below steam temperature. Nobody has to put up with such trap troubles!

Take a tip from this solution!—Henry T. Maass, Building and Utility Supt., took action. He ran extensive pyrometer tests on his driers, using different makes of traps.

100° hotter!—The driers are now equipped with Armstrong inverted bucket steam traps. Temperatures correspond to steam pressure—100 degrees hotter than before. Maintenance?—negligible. Rochester carries $63.31 of Armstrong trap parts in maintenance store against $873.52 in parts for another make of traps that haven't been replaced yet.

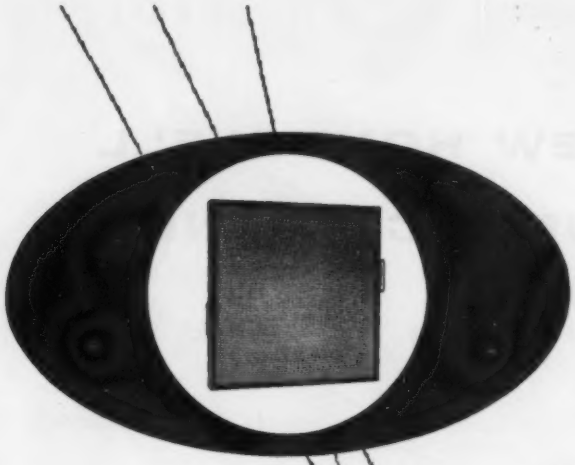
Moral—A small investment in Armstrong steam traps can make a world of difference in performance of production equipment and in cost of maintenance. Call your local Armstrong Representative, he has the products and the experience and the ability to be of real assistance.

FREE CATALOG

The 44-page Steam Trap Book is "the handbook of steam-trapping". Selection, installation, maintenenance, capacities, data, prices, tables, charts, useful material—yours for the asking without any obligation. Also see data in Sweets or Chemical Engineering Catalog.

Armstrong Machine Works
874 Maple Street, Three Rivers, Michigan

Application Engineered
ARMSTRONG STEAM TRAPS



NOW—
you can be sure you are right

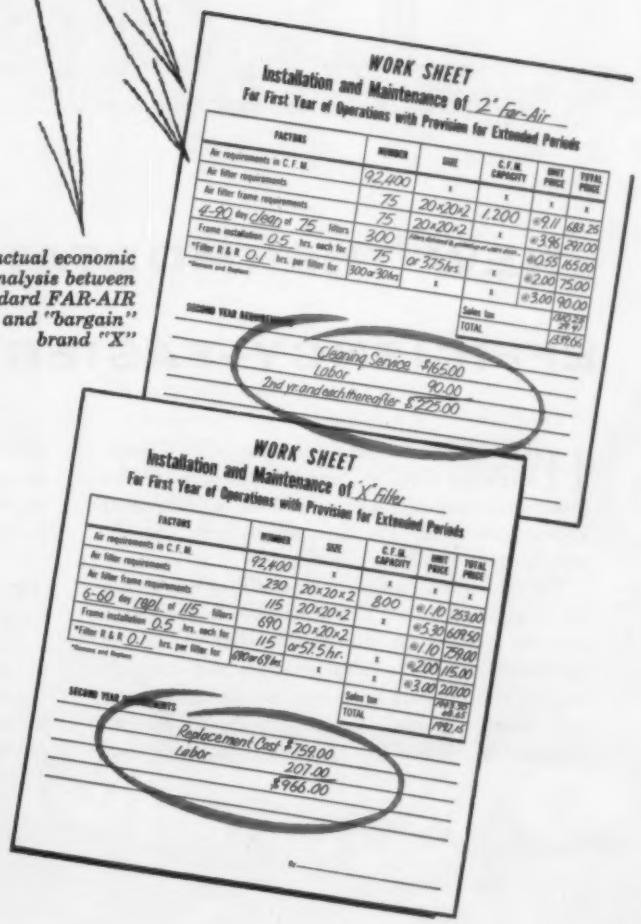
Because most filters are efficient at cleaning air, you are reasonably sure of getting a satisfactory job when you install an established make. The service life of your expensive air conditioning machinery and the comfort of your building depend on the ability of relatively low cost filters to do their job.

FARR Company, as one of the country's leading filter manufacturers, wants to insure that your are getting the most value out of your present filters, regardless of make. Therefore, they will send a field engineer who is an air filtration expert, to carefully analyze your air filters and submit a factual, written report like the one shown, on his findings. Often he can make suggestions that will greatly increase your filtration efficiency and save a substantial amount of money in operating costs.

FARR Company is making this service available to you on a no cost basis because it will increase your appreciation for the function of the often-neglected air filters. It will point out the importance of buying standard brand filters. It will in some cases result in sales for FAR-AIR filters . . . and that is important, too.

Why not try this service? It is factual, honest and subject to favorable comparison by any reputable manufacturer. Write today to Farr Company, P.O. Box 45187, Airport Station, Los Angeles 45, Calif.

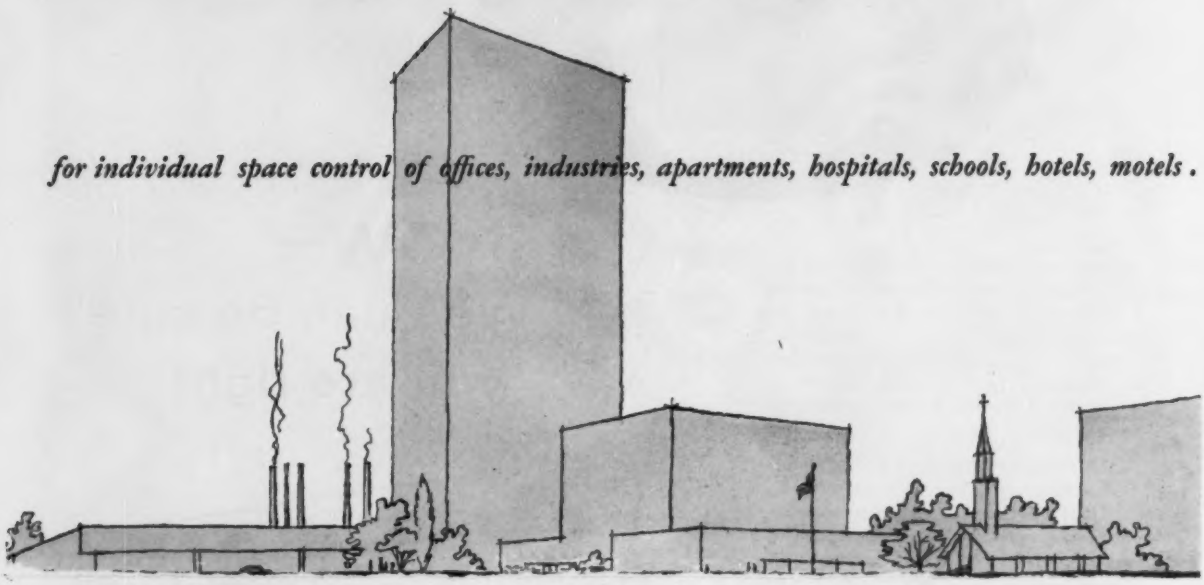
An actual economic analysis between standard FAR-AIR filters and "bargain" brand "X"



FARR COMPANY
NO COMPROMISE ON QUALITY
Los Angeles, New York, Chicago
New Orleans

THE NEW HONEYWELL PNEUMATIC ROUND

for individual space control of offices, industries, apartments, hospitals, schools, hotels, motels.



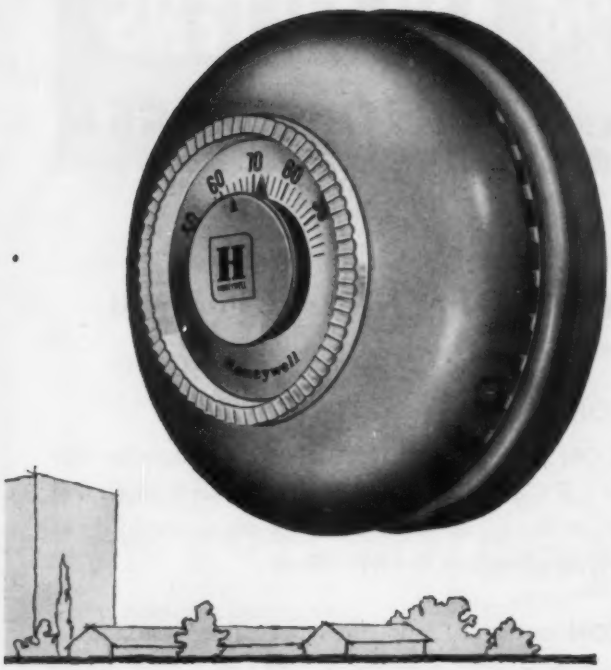
NEW THERMOSTAT BEAUTY AND EFFICIENCY–EASIER INSTALLATION

HERE'S the first completely new pneumatic thermostat since 1939. And one that blends beautifully into the contemporary interiors of modern commercial architecture. Henry Dreyfuss, world-famous industrial designer, was design consultant.

The Honeywell Pneumatic Round is as easy to use as it is pleasing to look at. But its most revolutionary features are not on the outside—but inside the removable metal case. New concepts and materials provide extraordinary sensitivity, precise modulation and instant response. So you get ideal comfort no matter what the building conditions or outside temperature might be. Eight major engineering improvements facilitate installation and maintenance. Yet the Pneumatic Round is rugged enough to withstand shock and tampering.

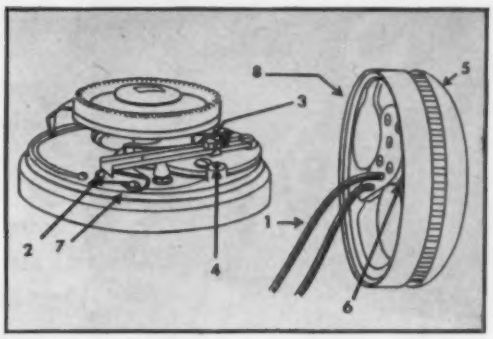
It's easy and it's inexpensive to replace old-fashioned thermostats with the Pneumatic Round when you modernize or decorate.

For present and proposed commercial buildings, for individual apartment or office temperature control, Honeywell's new Pneumatic Round offers the utmost in comfort, convenience and beauty—at the same price as ordinary pneumatic thermostats.



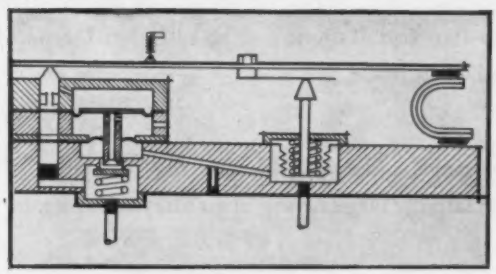
So beautiful, so easy to decorate

The simplicity and beauty of the new Pneumatic Round complement all modern interiors. The bronze-colored metal cover may be lifted off and painted to blend with the color of walls or furnishings. Setting and reading are simplified by one easy-to-read scale which serves both the thermometer and the setting indicator. Adjustable stops inside allow your client to limit the temperature range or lock the desired setting in place if he wishes.



So mechanically superior in detail

1. New flexible plug-in tubes will not crimp or collapse.
2. Quick calibration by simply turning screw with screwdriver.
3. Easily adjusted throttling range.
4. Simple plug-in gauge easily tests branch line air pressure.
5. Bronze-colored cover may be lifted off and painted to blend with walls.
6. Tight filter keeps air clean.
7. Simpler construction with fewer parts.
8. Flush or surface mounting. For modernization, a special adaptor plate covers hole left by old thermostat.



So precise and sensitive

The Pneumatic Round borrows the force-balance principle from precision industrial instruments to provide an automatic self-check on every change in the signal. It introduces a tiny new low-mass bimetal element so sensitive that it responds almost instantly to temperature changes. The result is the most precise modulation, the fastest response of any pneumatic thermostat on the market. And this means efficient working and living temperatures.

MINNEAPOLIS
Honeywell

First in Controls

112 offices across the nation

YOU CAN'T MATCH DYCON CA-24 AIR FILTERS FOR ECONOMY AND PERFORMANCE

HERE are the facts . . . figure it out for yourself!

ECONOMY FACTS:

1. **DYCON** has exceptional dust holding capacity 526 grams of A.F.I. dust per 1000 CFM rating. That means it will perform efficiently *four times as long between* servicings as other widely advertised dry-type filters.

2. **DYCON** media is "semi-permanent". Just wash and re-use. With reasonable handling a DYCON CA-24 can be serviced two dozen times or more before the media blanket will need replacement. Servicing consists of merely flushing with cold water. Installations may be such that Dycon filters can be washed in place.

SUMMARY: **DYCON** requires fewer servicings, and DYCON servicing cuts labor and material costs to a minimum. Net result is a relatively large saving in air filtration costs.

PERFORMANCE FACTS:

1. DYCON CLEANING EFFICIENCY is *unsurpassed* by any other dry-type filter on the market.

2. CONTINUED LOW RESISTANCE throughout the long dust-loading period is *unequalled* by any other filter.

3. DYCON CA-24 is listed by *Underwriters Laboratories.*

Trouble-free, effective, low-cost air filtration is spelled: "DYCON CA-24." The Continental representative in your area will gladly help you figure the large savings you can effect with CA-24's in your system. Call him today—or write direct.

SAVINGS IN MAINTENANCE COSTS WITH CA-24's GRAPHICALLY SHOWN

IN STANDARDIZED AIR FILTER TESTS

CERTIFIED ARRESTANCE and RESISTANCE DETERMINATIONS

——— **DYCON** model **CA-24**

– – – – **FILTER "A"** (name on request)

GENERAL TEST DATA

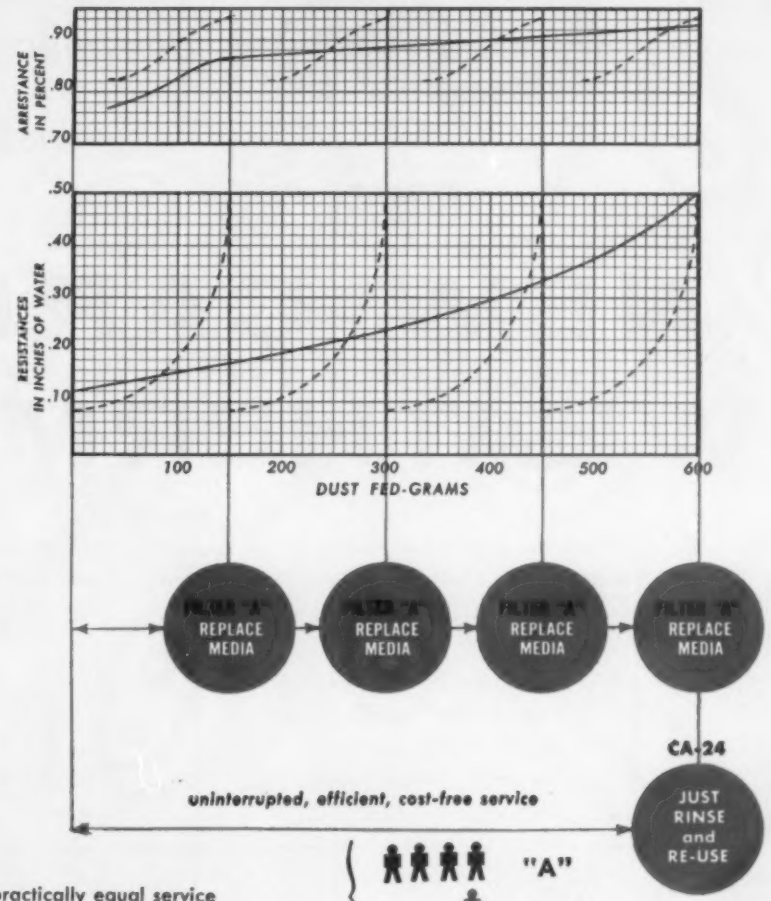
TEST DUST:	A.F.I. Standard Test Dust
AIR CAPACITY — CFM:	1000
RATE OF DUST FEED — GRAM PER HOUR:	37.5
NOMINAL DIMENSIONS —	24" x 24" x 8¾"

PERFORMANCE DATA: DYCON

DUST HOLDING CAPACITY — GRAMS:	526
AVERAGE ARRESTANCE — PERCENT:	88

PERFORMANCE DATA: FILTER "A"

DUST HOLDING CAPACITY — GRAMS:	132
AVERAGE ARRESTANCE — PERCENT:	88

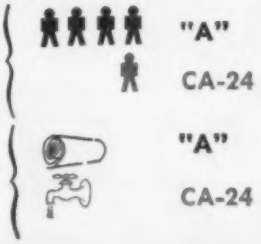


TESTS SHOW:

Both filters render practically equal service

CA-24's eliminate 75% of maintenance labor costs

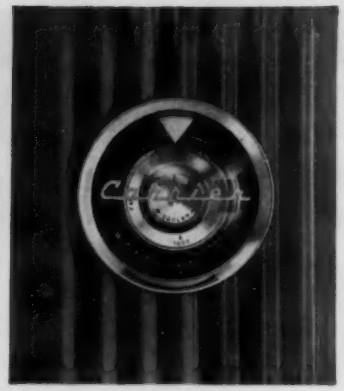
CA-24's eliminate maintenance material cost



AIR CONFIDENTIAL FILTERS

P. O. BOX 1647 LOUISVILLE 1, KY.

CONTINENTAL AIR FILTERS Inc.



New Golden Aerodial. It's 22-karat gold-plated and beautiful. Lucite dome hinges over main control, thermostat knob and reset button. Easy reset reduces service calls.

the all-new, all-around air conditioner designed for lower installation costs!

NEW CARRIER WEATHERMAKER

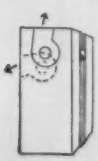
Here's the first self-contained air conditioner designed for lower installation costs—with or without ductwork. Check these exclusive new time-and-trouble-saving features:

ADAPTABLE five-way air return. Duct return through bottom or back. Or matching pedestal base can be added so air returns at front or sides.

PRE-WIRED electrical center. All connections are made in one outlet box at the side. No additional internal electric wiring is necessary.

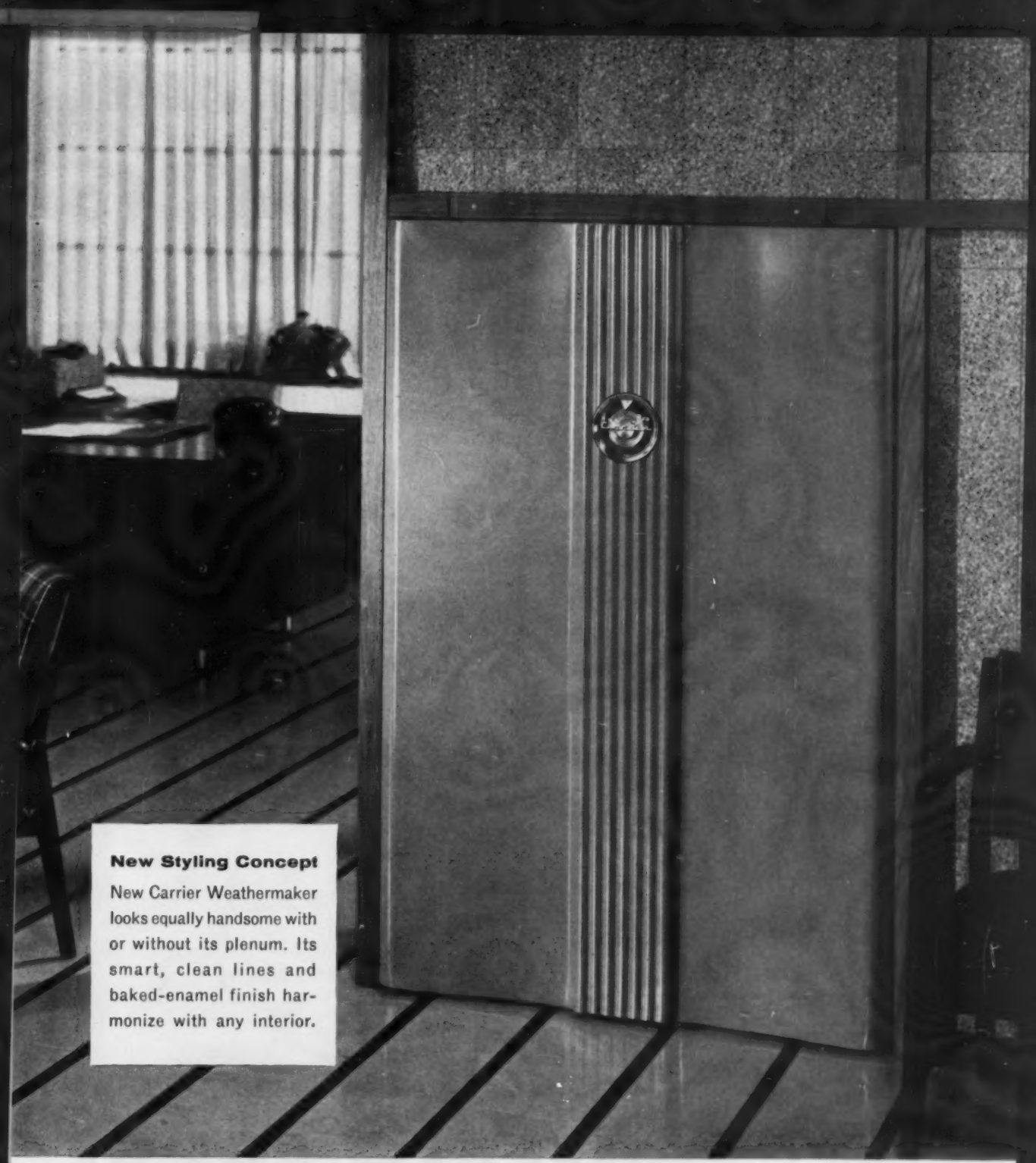
EXCLUSIVE solid front panel. No return air grille to block off for duct jobs. Snap locks release panel for easy access. No tools are needed.

EXTRA-LARGE add-on plenum. Easily mounted for installations not requiring ductwork. Hinged grille panel is counterbalanced for easy access. Full directional air control.



ALTERNATE fan discharge. L-shaped fan platform easily inverted for rear discharge where headroom is low. You avoid costly cutting and patching of unit in changing flow.

BUILT-IN PROVISION for heating coil. No need to alter unit when you add matching heating coil—uses either steam or hot water to heat the same area cooled by unit.



New Styling Concept

New Carrier Weathermaker looks equally handsome with or without its plenum. Its smart, clean lines and baked-enamel finish harmonize with any interior.

TOO NEW TO VIEW? No sir. You can see the new Weathermaker at your Carrier dealer's or distributor's today! Check it over. Inspect its 24 great features. Then, for the real payoff, ask about prices and availability!

FREE CATALOG! Full details and complete specifications on the new Carrier Weathermaker. Just mail the coupon.

CARRIER CORPORATION, 305 S. Geddes Street, Syracuse, New York

I'm interested in your new Weathermaker and want to see the specs. Please rush me a catalog.

Name_____

Firm_____

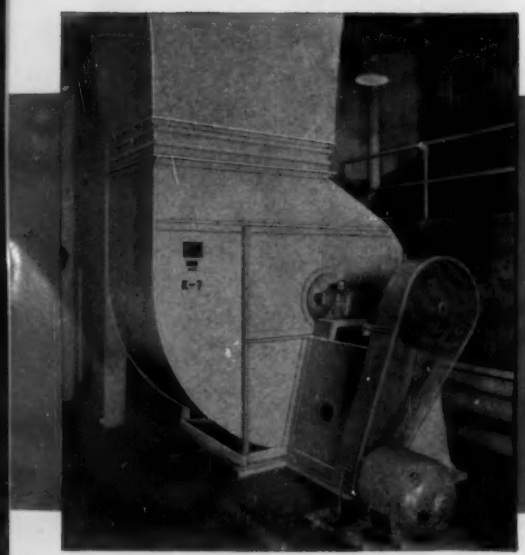
Address_____

City_____ Zone_____ State_____

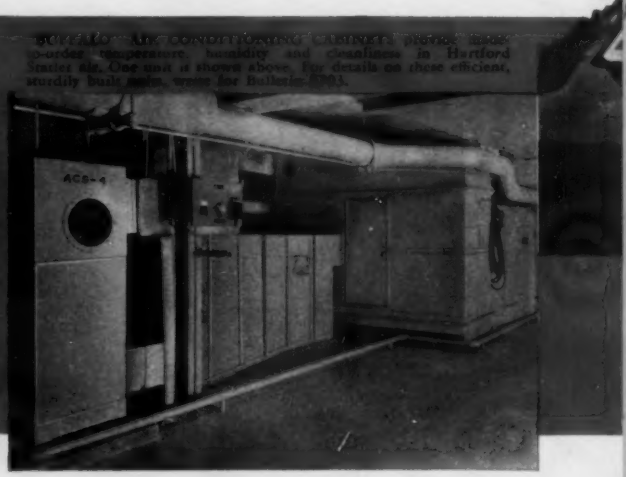
Another Statler Hotel for AIR COMFORT AT ITS

The handsome new Statler Hotel in Hartford, Conn. is another in the long list of large buildings enjoying air comfort by "Buffalo". This installation includes ventilation in all public rooms and service areas by "Buffalo" Fans, plus ideal climate for these areas, provided by "Buffalo" Air Conditioning Cabinets. The large quantities of chilled water and hot water needed for the air conditioning system and power plant are efficiently delivered by "Buffalo" Centrifugal Pumps.

Insure permanent satisfaction in every air and liquid handling job by specifying the "Q" Factor* units used in many of the country's finest installations for 78 years — "Buffalo" units.



"BUFFALO" VENTILATING FANS like this low-decibel, high-performance Type "BL" Fan do a highly satisfactory ventilation job and supply air for the air conditioning cabinets. These fans are non-overloading and very stable in performance. For ratings, write for Bulletins F-102 and 3720.



"BUFFALO" AIR CONDITIONING CABINETS provide year-round temperature, humidity and cleanliness in Hartford Statler air. One unit is shown above. For details on these efficient, sturdily built units, write for Bulletin 3703.

BUFFALO FORGE

171 MORTIMER STREET

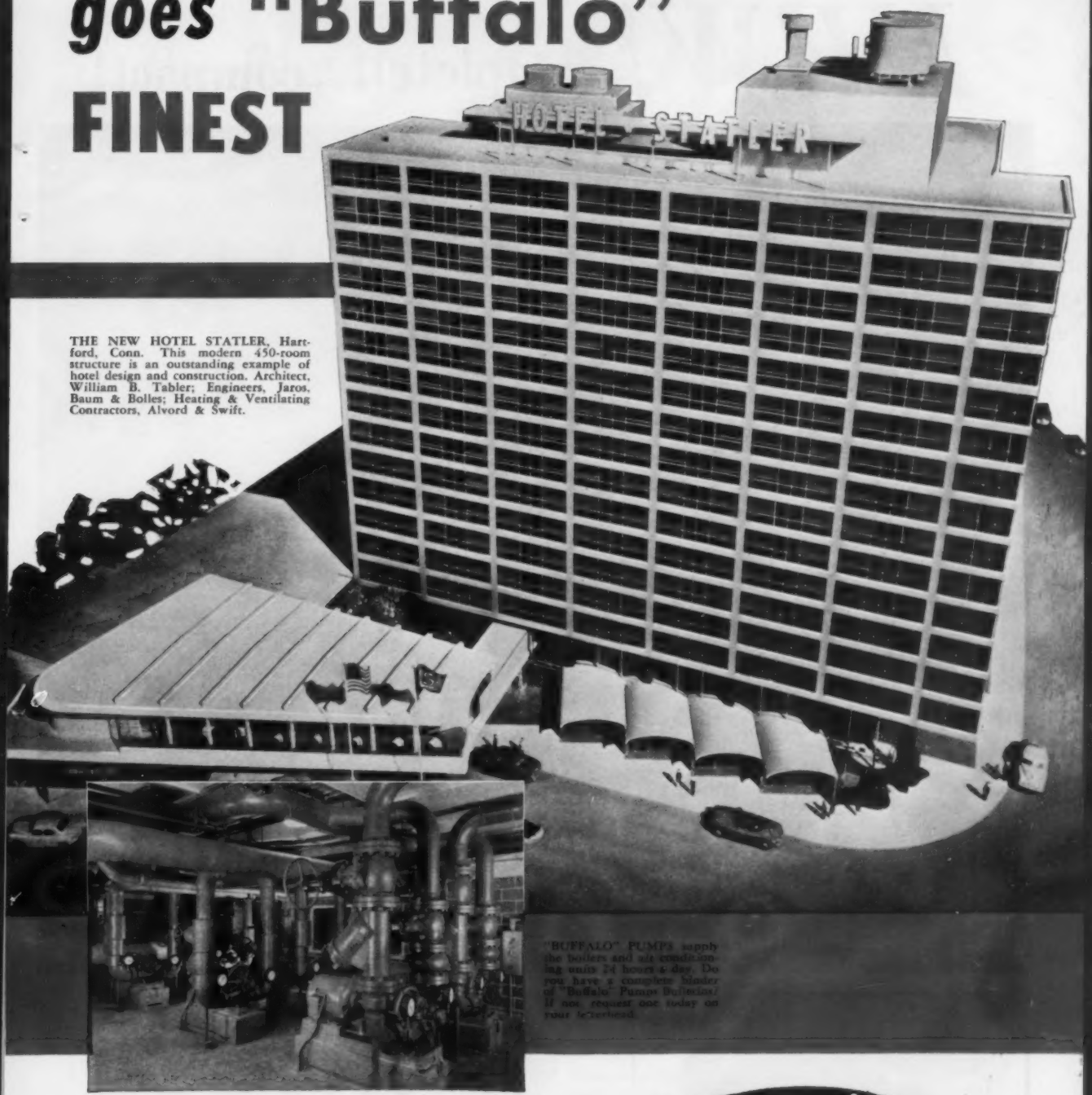
PUBLISHERS OF "FAN

Canadian Blower & Forge Co.,

SALES REPRESENTATIVES

VENTILATING AIR CLEANING AIR TEMPERING INDUCED DRAFT

goes "Buffalo" FINEST



THE NEW HOTEL STATLER, Hartford, Conn. This modern 450-room structure is an outstanding example of hotel design and construction. Architect, William B. Tabler; Engineers, Jaros, Baum & Bolles; Heating & Ventilating Contractors, Alvord & Swift.

"BUFFALO" PUMPS supply the boilers and air conditioning units 24 hours a day. Do you have a complete binder of "Buffalo" Pumps Bulletins? If not, request one today on your letterhead.

COMPANY

BUFFALO, N. Y.

ENGINEERING" HANDBOOK

Ltd., Kitchener, Ontario

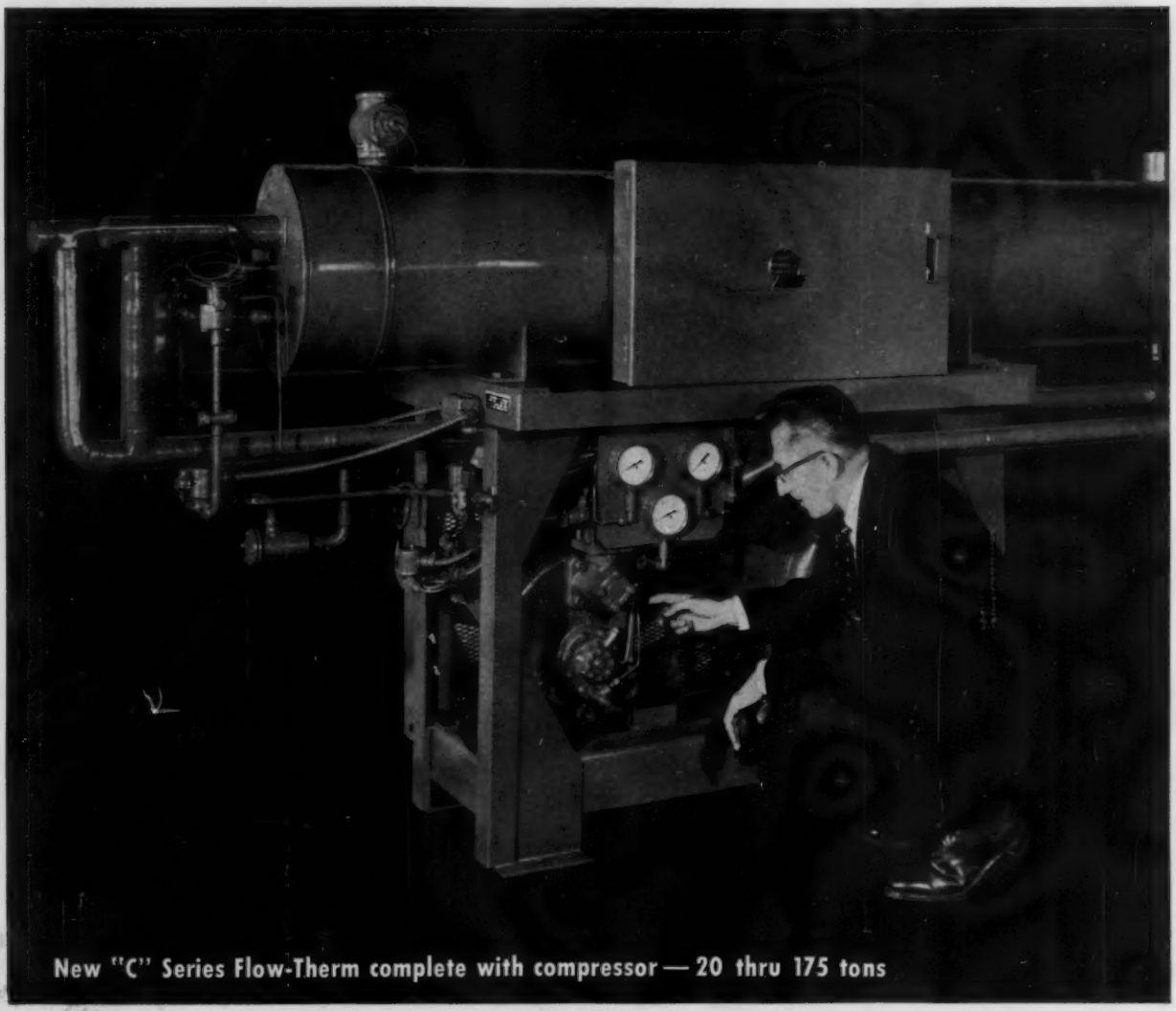
IN ALL PRINCIPAL CITIES

"Buffalo"

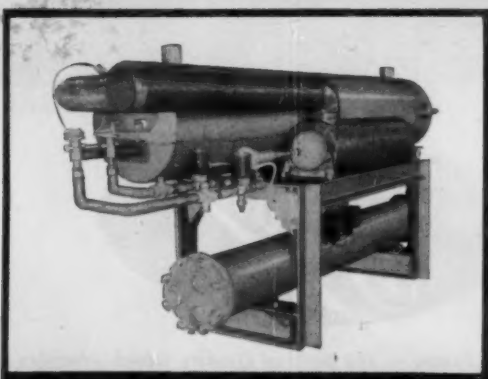
**The "Q" Factor — the built-in Quality which provides trouble-free satisfaction and long life.*

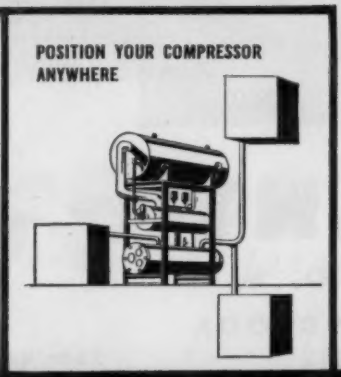
EXHAUSTING FORCED DRAFT COOLING HEATING PRESSURE BLOWING

NEW! complete!...compact!



New "C" Series Flow-Therm complete with compressor — 20 thru 175 tons





***Flexibility* —**

is the key feature of Acme's "R" Series Flow-Therm. It's a custom package, ready for remote mounting of compressor. The major components, Acme Dry-Ex and condenser are selected to provide the exact capacities needed for economy both in first cost and in operation. Mounting arrangements available to fit the requirements of floor space and head room.

"R" Series Flow-Therm for remote compressor mounting 15 thru 300 tons.

...the Flexible *Acme* FLOW-THERM®

fills your packaged chiller needs for economical installation, dependable performance

Here it is — Acme's new "C" Series Flow-Therm compact package complete with compressor — designed specifically for modern refrigerants. Constructed with proven Acme components, including a great new Dry-Ex®, it's a packaged liquid chiller that fits all the requirements of architects, consulting engineers and contractors for size, efficiency and ease of installation.

The Flow-Therm arrives on the job completely assembled and factory tested, ready for refrigerant charging and connection to power and liquid supply lines. Whether the application is air conditioning or process cooling, you save the engineering of a built-up system, make easier, more accurate quotations to customers, and gain fast, economical installation.

Why is this new package so compact and efficient? One reason is Acme's new Dry-Ex, a smaller, lighter chiller that packs 25% more cooling capacity in every cubic foot. In addition, size of compressor, condenser and heat exchanger are balanced to put maximum capacity in a minimum space. Proved components, correct controls, and factory-installed piping mean long trouble-free service.

FLOW-THERM proven as Heat Pump

Heat pump applications have been successful in a wide range of climates. Factory modifications for heat pump use are simple and inexpensive.

USE COUPON BELOW TO GET FULL FLOW-THERM DETAILS

- ☆ ***Simplifies engineering***
- ☆ ***Makes estimating accurate***
- ☆ ***Space-saving size***
- ☆ ***Balanced, proven components***
- ☆ ***Less maintenance***

Star feature —

of the new Acme Dry-Ex — key component of the Flow-Therm —is a new copper tubing with a star-shaped aluminum insert* that more than doubles the heat transfer surfaces. Tubes extend straight through to multi-pass heads at each end. No bends, no soldered joints — no leaks!

*Patent applied for

ACME INDUSTRIES, INC. JACKSON, MICHIGAN

New selection procedure simplifies your engineering task

Send me the complete new catalog on Flow-Therm packaged liquid chillers.

Name..... Title.....

Address.....

City..... Zone.....

State.....

Manufacturers of Quality Air Conditioning and Refrigeration Equipment since 1919

Examine the evidence...

Century

FRACTIONAL HORSEPOWER MOTORS

Superior performance in a smaller "package"

Totally Enclosed Fan Cooled

Century Fractional Horsepower Motors are quiet running, precision balanced and unusually free from vibration. They can be Performance-Rated to your specific needs in split-phase, capacitor and polyphase types with the following mechanical modifications:

Open Type Drip Proof with Cushion Base

Open Type Drip Proof with Rigid Base

Can Be Furnished with Bracket or Flange Mounting

Century application engineers or authorized Century distributors are always at your service to help you fit a Performance-Rated motor to your job.

ROTOR

practically indestructible, high-pressure die-cast aluminum squirrel-cage rotor . . . assures uniform cross section of winding. Large capacity fans are cast integrally with the rotor winding for improved ventilation.

INSULATION

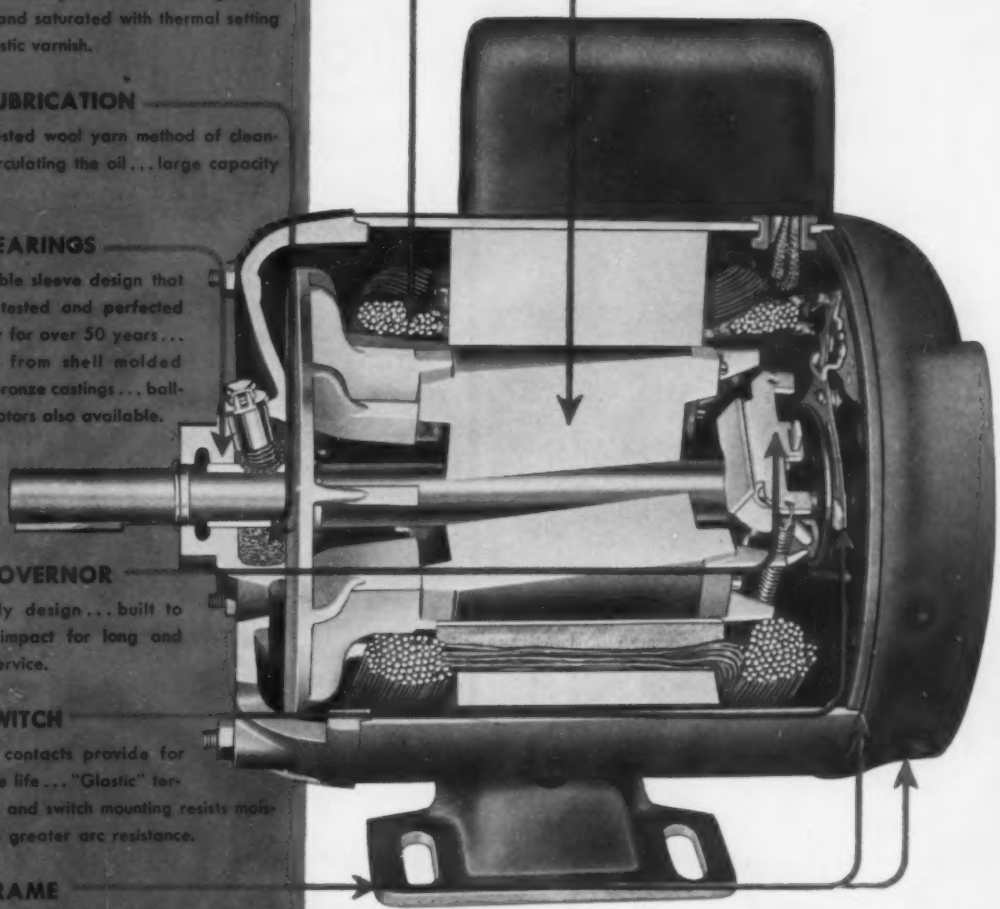
stator winding slots are insulated with laminated rag stock paper and costly "Mylar." "Formvar" plastic insulated wire is used for the coils. The complete stator winding is dehydrated and saturated with thermal setting baked plastic varnish.

LUBRICATION

the time-tested wool yarn method of cleaning and circulating the oil . . . large capacity reservoir.

BEARINGS

same reliable sleeve design that has been tested and perfected by Century for over 50 years . . . machined from shell molded Phosphor bronze castings . . . ball-bearing motors also available.



GOVERNOR

new, sturdy design . . . built to withstand impact for long and accurate service.

SWITCH

coin-silver contacts provide for long service life . . . "Glastic" terminal base and switch mounting resists moisture . . . has greater arc resistance.

FRAME

heavy gauge steel, accurately machined for close-tolerance fit with the cast iron, drip proof end bracket. Base is welded to the frame and the bottom is milled for solid mounting and accurate centering.

Visit Century booth 508
Air Conditioning and Refrigeration Exposition
Atlantic City, Nov. 28 to Dec. 1, 1955

CE-22R

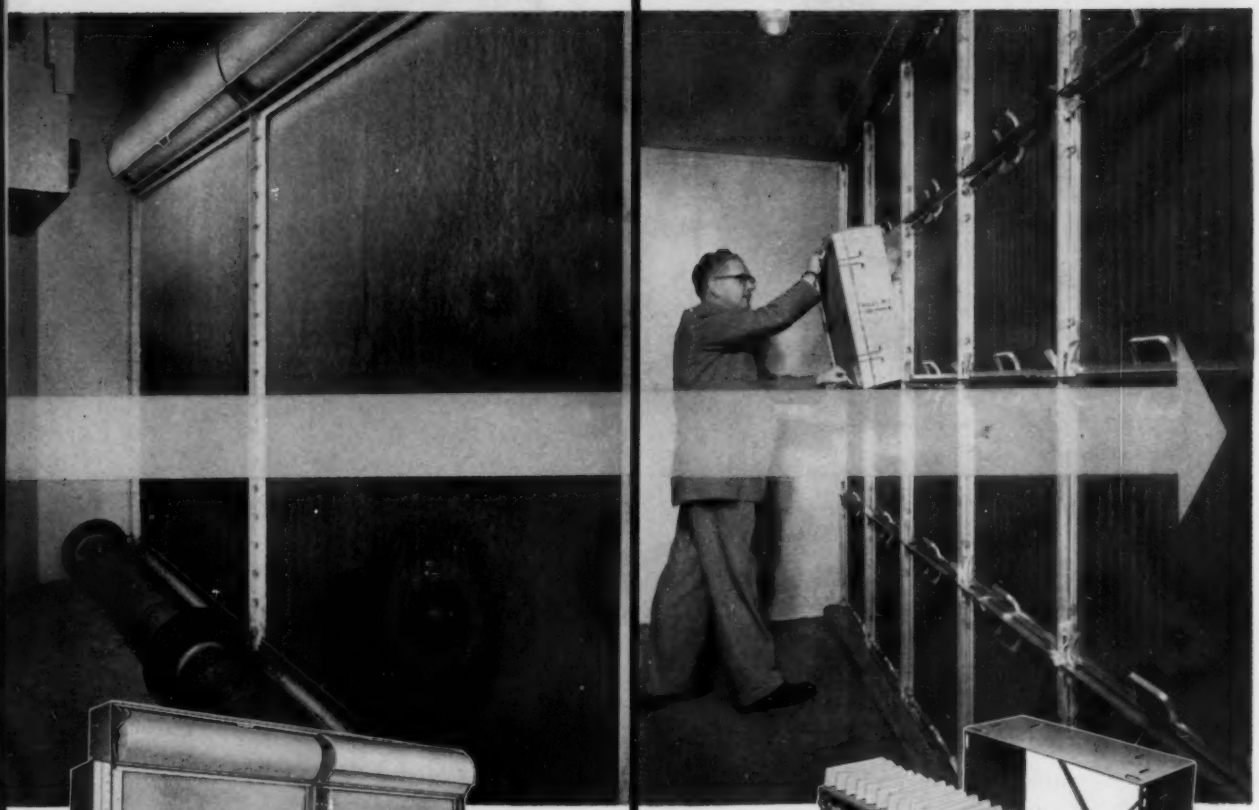
Performance-Rated© MOTORS
1/8 to 400 H. P.

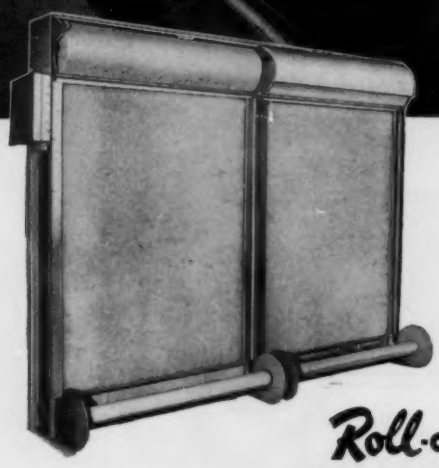
CENTURY ELECTRIC COMPANY

1806 Pine Street, St. Louis 3, Missouri • *Offices and Stock Points in Principal Cities*

Super-clean air with

PRIMARY | **SECONDARY**





Roll-O-MATIC

While collecting all but the minute particles of dust and smoke, ROLL-O-MATIC carries out its own maintenance program. Filter curtain, consisting of a 5 ft. wide by 70 ft. long "blanket" of bonded glass fibers, compressed into a roll 13" in diameter, is mounted at top of unit. Controlled by an automatic timer, the curtain moves down face of filter to maintain desired operating resistance and the dirt-laden media re-rolled on spool at bottom. Rolls are changed like the film in a camera.

AAF

Electro · PL

A perfect trap for the tiny particles of smoke and dust remaining in the airstream! The Electro-PL is a dry type electronic filter combining high efficiency with simplified design. Its Airmat paper media is low in cost and after accumulating a full dust load is easily replaced with clean media which returns filter to its original efficiency.

The combination AAF air filter installation pictured above is part of air conditioning system serving the American National Bank, Chicago, Ill. System was installed by Kroeschell Engineering, Chicago, Ill.

minimum care

Self-Servicing Roll-O-MATIC Teams With Electro-PL Filter to Form Highly Efficient "Care-Free" Air Cleaning Operation

Here are two filters that "pool" their basic features to bring you performance and maintenance advantages not found in any single air filter type. This versatile combination was created for those operations demanding super-clean air but whose location in areas of heavy dust concentrations posed a constant and costly filter maintenance problem.

CLEANING EFFICIENCY— HEAVY DUST TO ELUSIVE SMOKE

ROLL-O-MATIC, serving as the primary cleaner, collects the heavy portion of the dust load—removes all but the minute particles of dirt and smoke.

"Clean-up position" falls to the Electro-PL. This electronic filter completes the job—collecting the small particles of dust and smoke that so frequently cause product contamination as well as smudging and discoloration of interior surfaces.

MAINTENANCE—SELDOM AND SIMPLE

The primary cleaner usually poses a maintenance problem due to the nature of the dust load collected. But not the ROLL-O-MATIC! Its removable media filter curtain assures highest cleaning efficiency automatically for weeks and months on end—with maintenance reduced to once-a-year replacement of the Roll-O-Mat media.

Light nature of the Electro-PL's dust load makes for infrequent maintenance which consists of simple replacement of the Airmat paper media.

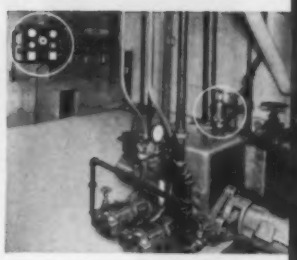
Whether it takes one or a combination of filter types to solve your problems, AAF has both the experience and line of product to meet your needs in the most effective and economical manner. A call to your nearby AAF representative will put all the resources of "Air Cleaning Headquarters" at your disposal.

American Air Filter
COMPANY, INC.
373 Central Avenue, Louisville 8, Kentucky
American Air Filter of Canada, Ltd., Montreal, P. Q.

AFI MEMBER

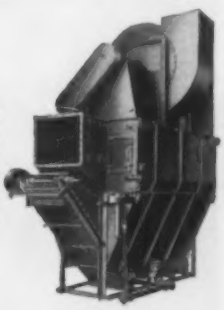
BETTER AIR IS OUR BUSINESS!

illinois
Selectotherm — an automatically controlled high vacuum steam heating system which, through single dial control, balances heat supply against heat loss to provide even, constant warmth.



herman nelson
Unit Blowers — a new, diversified line of direct and belt driven centrifugal fans available in a wide range of wheel diameters and capacities.

AAF Type N ROTO-CLONE—a high efficiency hydro-static precipitator designed for the collection of both coarse particles and extreme fines in excessive concentrations. Available in exhaust volumes up to 50,000 cfm.



American Air Filter Company, Inc.
373 Central Avenue, Louisville 8, Kentucky

I would appreciate receiving catalogs describing the following equipment—

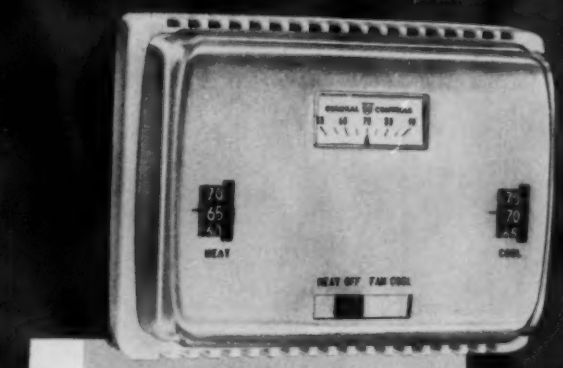
- ☐ ROLL-O-MATIC Air Filters
- ☐ Electro-PL Air Filters
- ☐ Illinois Selectotherm
- ☐ Herman Nelson Unit Blowers
- ☐ Roto-Clone Dust Control Units

Name_____

Company_____

Street_____

City_____ State_____



T-231

COMBINATION HEATING AND AIR CONDITIONING THERMOSTAT

... complete, one-point control of full year 'round comfort system ... independent mercury switch thermostats and settings ... single three-way switch for heat, cool or fan-only functions. Other automatic changeover and combination models available.

T-99

MERCURY SWITCH THERMOSTAT

... hermetically sealed contacts ... integral heat anticipation ... independent roll-dial with large numerals ... satin finish, lifetime stainless steel case.

The "wallmark" of quality for the heating and air conditioning industry

Matched design for matchless performance

no selection so complete,
no styling so beautiful
as in General Controls'
slim silhouette
room thermostats

These are three of many good reasons why you find more and more General Controls thermostats in *perfect control* in homes across the nation: *Manufacturers* know they can rely on them to bring out the very best in the products they build; *dealers* install them confident in their ability to guarantee customer satisfaction and goodwill; and *homeowners* proudly select them for the faultless beauty of their *slim silhouette* styling, and the famed dependability of their straight-line temperature control. All three special viewpoints agree on the one right answer to their individual problems—*the General Controls matched line for matchless performance—in every department!*

T-265

TIMER ROOM THERMOSTAT

...handsome slim silhouette in horizontal design... automatic settings for day and night temperatures... dependable manual type spring timer.

T-270

TEMPOTHERM CLOCK THERMOSTAT

...for accurate and convenient day-night temperature control ...with handsome, dependable electric clock for automatic control changeover from day to night. Standard with mercury switch contacts.

General Controls
SLIM
SILHOUETTE
room
thermostats

There is a General Controls thermostat "custom tailored" to every heating system: oil, gas, electric and coal. Mercury switch, snap action, or thermopoised types in standard, hand wound timer, electric clock, and combined heating and cooling models. Write for complete details today.

GENERAL CONTROLS

MANUFACTURERS OF AUTOMATIC CONTROLS FOR HOME, INDUSTRY AND THE MILITARY

GENERAL CONTROLS • PERFEX CONTROLS

40 FACTORY BRANCH OFFICES SERVING THE UNITED STATES AND CANADA

FIVE PLANTS: IRON MOUNTAIN, MICHIGAN • GLENDALE, CALIFORNIA • BURBANK, CALIFORNIA • SKOKIE, ILLINOIS • GUELPH, CANADA

a big air conditioning job
for a big building

1100 MARLO SEAZONAIRES

...TO COMFORT CONDITION SOUTHWESTERN BELL TELEPHONE COMPANY OFFICE BUILDING

Remote Room Units Will Provide Summer Cooling, Winter Heating for 26-story St. Louis Skyscraper.

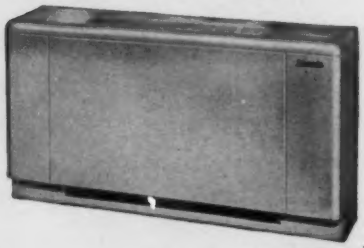
●

One of the largest air conditioning installations ever made in a St. Louis office building, totalling 1800 tons, is under way. By next summer, this structure, the tallest in the city, will be provided with an efficient year-round comfort conditioning system.

Over one thousand Marlo Seazonaire Remote Room Air Conditioning Units will be installed. These versatile, flexible units will permit occupants of each office to regulate temperatures to their own preference.

Engineers on the mammoth installation project are Weil and Moses, New Orleans. Sodemann Heat and Power Co., St. Louis, is the air conditioning contractor.

Write Today for New Bulletin on Marlo Seazonaire Air Conditioning.



SEE OUR DISPLAY AT THE ALL-INDUSTRY SHOW ATLANTIC CITY NOV. 28–DEC. 1

MARLO coil co.

SAINT LOUIS 10, MISSOURI

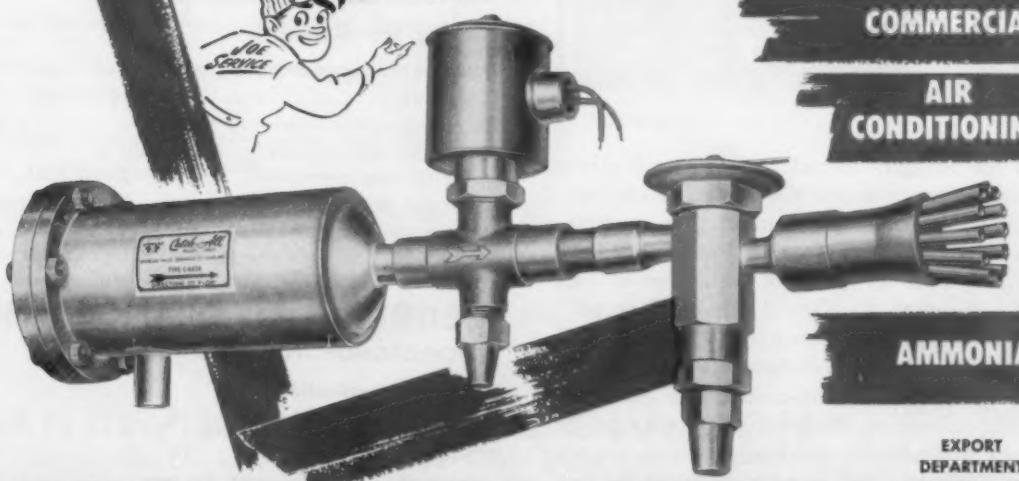
Quality Air Conditioning and Heat Transfer Equipment Since 1925

Right down the Line Peak Performance doesn't Just Happen!

SPORLAN

Sporlan's
perfect combinations of
Catch-All filter driers, Solenoid Valves
Thermostatic Expansion Valves and
Refrigerant Distributors alone can give you
the perfect hook up for any size installation

That is why **when you buy SPORLAN throughout you know you'll get Right-down the Line Peak Performance**
on all Refrigeration Systems . . .



COMMERCIAL
AIR CONDITIONING
AMMONIA

SPORLAN VALVE COMPANY
7525 SUSSEX AVENUE ST. LOUIS 17, MO.

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89 BROAD ST.
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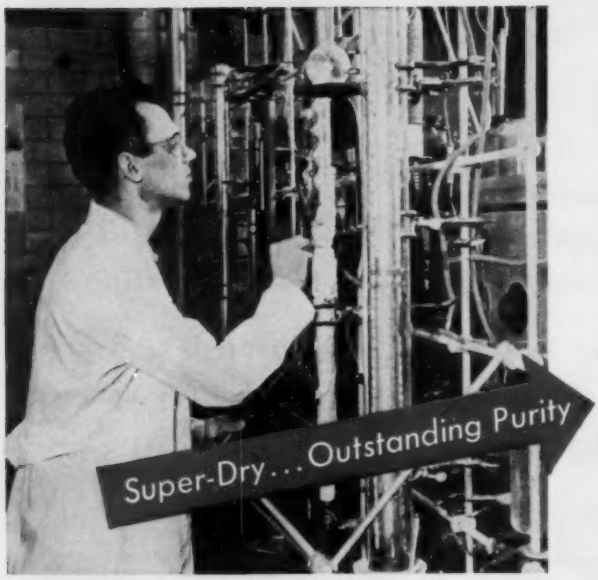
APPR

Leading Refrigeration and Air

genetron®



Look at the stringent manufacturing specifications listed here for the principal "Genetrons." Note their exceptionally low moisture content. For example, "Genetron" 12 and "Genetron" 141 are so dry they contain less than ten parts of water per million parts of refrigerant. That's moisture equal to only one thousandth of one percent (0.001%).

The overall purity of "Genetrons" is equally good. See how low they are in non-condensable gases and low boiling impurities. And, remember the quality of current production consistently surpasses even these specifications. No wonder so many leading manufacturers now prefer "Genetrons" as original charge for their equipment!

genetron 12—WHITE LABEL

DICHLORODIFLUOROMETHANE

Quality Specifications

Moisture wt. %, max.	0.0010
Chlorides	none
High boiling impurities—vol. %, max.	0.05
Non-condensable gases (gases insoluble in perchloroethylene)—vol. % in vapor phase, max.	1.5
Boiling pt. at 760 mm. Hg °F.	−21.6
Boiling range °F (to 85% pt.), max.	0.9

genetron 141—GREEN LABEL

MONOCHLORODIFLUOROMETHANE

Quality Specifications

Moisture wt. %, max.	0.0010
Chlorides	none
High boiling impurities—vol. %, max.	0.05
Non-condensable gases (gases insoluble in perchloroethylene)—vol. % in vapor phase, max.	1.5
Boiling pt. at 760 mm. Hg. °F	−41.4
Boiling range °F (to 85% pt.), max.	0.9

genetron 11—ORANGE LABEL

TRICHLOROMONOFLUOROMETHANE

Quality Specifications

Moisture wt. %, max.	0.0015
Chlorides	none
High boiling impurities—vol. %, max.	0.05
Boiling pt. at 760 mm. Hg. °F	74.7
Boiling range °F (to 85% pt.), max.	0.5

OVED!

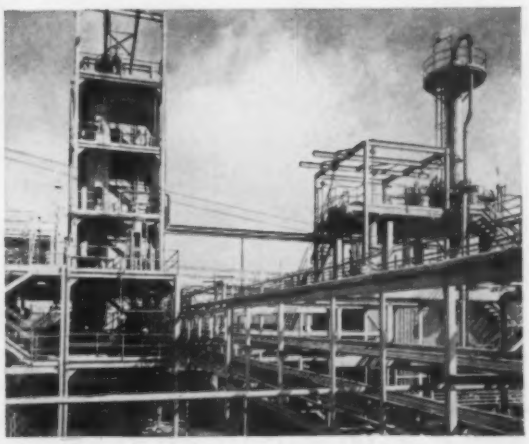
Conditioning Manufacturers All Approve...

Super-Dry Refrigerants

Few products have ever undergone such exhaustive examination as "Genetron" Refrigerants. Leading refrigeration and air conditioning manufacturers have checked and rechecked them intensively . . . proved for themselves that "Genetrons" meet or surpass their most exacting specifications for fluorinated hydrocarbon refrigerants.

Yes . . . in every case . . . "Genetrons" have been certified for the original or replacement charge in America's finest equipment. That's because they have been proved to be—

- **Super-Dry—guaranteed exceptionally low moisture content.**
- **Non-toxic, non-flammable, stable, safe.**
- **Non-corrosive to standard equipment materials.**
- **Critical and freezing points well outside range of operating uses.**
- **Solvent action on oil helps prevent solidification or congealing of lubricant.**
- **Miscible with oil; aid in lubrication of equipment.**
- **Identical and interchangeable in all respects with comparable fluorinated hydrocarbon refrigerants produced by any other manufacturer meeting the same high standards.**



READY SOON:
In addition to its expanded "Genetron" production center at Baton Rouge, La., General Chemical will soon have large new "Genetron" facilities in operation at Danville, Ill. These, plus others in the industry, assure refrigerant capacity to meet all needs for the foreseeable future.

Basic Chemicals for American Industry

GENERAL CHEMICAL DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 Rector Street, New York 6, N. Y.

See your refrigeration wholesaler

Now!

a new, molded silica insulation

developed by

Johns-Manville Insulation Research

✓Can't shrink...

Fibrocel alone offers all these advantages

- No shrinkage—eliminates gaping joints
- Resists compression—firm in structure
- Uniform dimensions—precision formed for exact fit
- Economical application—lightweight, easy to cut with a knife
- Thermal effectiveness
- Permanence—flame, rot, odor and vermin proof

Can be easily installed—Fibrocel is light, easily cut with a knife. Uniform dimensions assure tight, smooth joints and neat appearance.

Johns-Manville *first-in*

✓Resists deformation...

✓Easier to apply...

FIBROCEL®

PIPE INSULATION

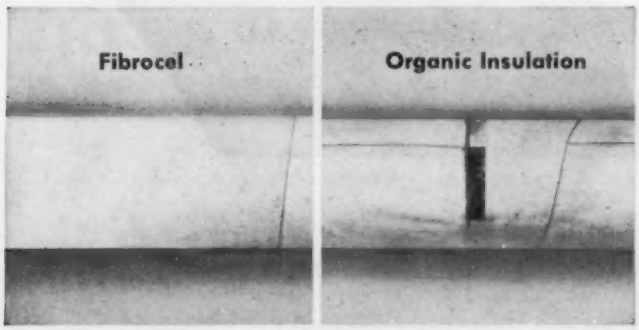
For plumbing, heating and air conditioning systems

● Johns-Manville Fibrocel is an entirely new concept in pipe insulation for the 35F to 300F temperature range. In the manufacturing process tiny particles of silica are exploded and expanded to form a cellular structure of "dead" air spaces. It incorporates in one material a combination of properties not found in any existing insulation for heating and plumbing service.

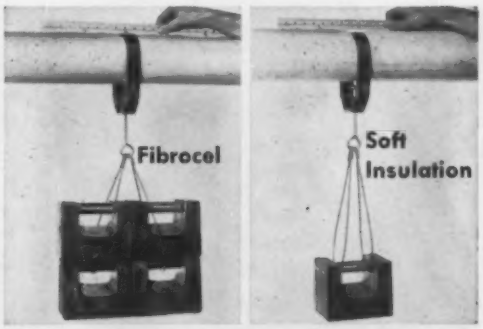
Fibrocel completely eliminates objectionable shrinkage caused by atmospheric changes. It permits no gaping, unsightly joints with accompanying heat leakage. Strong and firm in texture, Fibrocel resists deformation. Dimensionally uniform, it provides exact fit and neat appearance. Light in weight, it is readily handled. Fibrocel speeds application, keeps costs at a minimum.

This new insulation has been developed and tested in the world's largest insulation laboratory, located at the Johns-Manville Research Center. It has been proved in actual field installations. And it is backed by more than 96 years of Johns-Manville experience in insulation engineering.

Available now—Fibrocel is in commercial production. Architects, contractors, and engineers can secure full information from J-M District Offices. Or write for Brochure IN-155A, address Johns-Manville, Box 60, New York 16; in Canada, 565 Lakeshore Road East, Port Credit, Ont.



Joints stay tight—tests prove Fibrocel does not shrink, even after severe moisture exposure and service under continuous steam flow. Ordinary organic insulation shows substantial joint shrinkage after same test.



Withstands compression—tests prove Fibrocel suffers no deformation or compression even under 200-lb. weight. Softer type insulation shows marked deformation after being subjected to 50-lb. weight.

INSULATION MATERIALS · ENGINEERING · APPLICATION

JOHNS-MANVILLE JM PRODUCTS

PLASTIC

VALVES and PIPE FITTINGS

by

WALWORTH

These new corrosion-resistant valves and pipe fittings are molded of rigid polyvinyl chloride. They round out complete lines of Walworth Valves and Fittings of Steel, Stainless Steel, Bronze, Iron, and Special Alloys. A brochure explaining the complete Walworth PVC product story has been prepared for your information. Just send us your name and address. *Walworth Company, General Offices, 60 East 42nd Street, New York 17, New York.*

Main offices and plant of Pratt & Whitney Aircraft, East Hartford, Conn., in which Sarco Heating Specialties are installed. These Sarco products are used by all divisions of United Aircraft Corporation.

35 repeat orders from United Aircraft

for Sarco Heating Specialties!

First installation in 1933. Thirty-five installations since. That's the 22-year record of Sarco Heating Specialties in plants and office buildings of all United Aircraft Divisions.

35 *large* repeat orders...won by Sarco proved dependability!

Several thousand Sarco steam traps and other Sarco Heating Specialties are on the job at:

Pratt & Whitney Aircraft Div., East Hartford, North Haven and Southington, Conn., *Hamilton Standard Division*, Windsor Locks, Conn., *Sikorsky Aircraft Division*, Bridgeport and Stratford, Conn.

For further information on Sarco heating specialties, Sarcotherm weather-compensated control systems for steam and hot water heating, and Sarcofin finned-tube and baseboard radiation, write Sarco Company, Inc., Empire State Building, New York 1, N.Y.

SARCOfin Radiation

...another Sarco product

APPROVED RATINGS—by Institute of Boiler and Radiator Manufacturers for finned-tube and baseboard radiation.

1-YEAR GUARANTEE against defects in materials and workmanship.

COOPERATION—careful selection of radiation by experienced Sarco and Sarcotherm heating engineers.

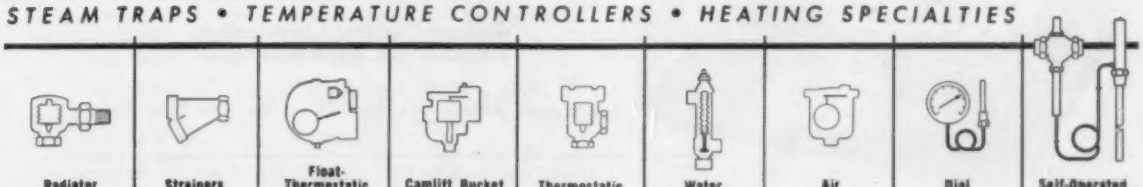
Write for Bulletins

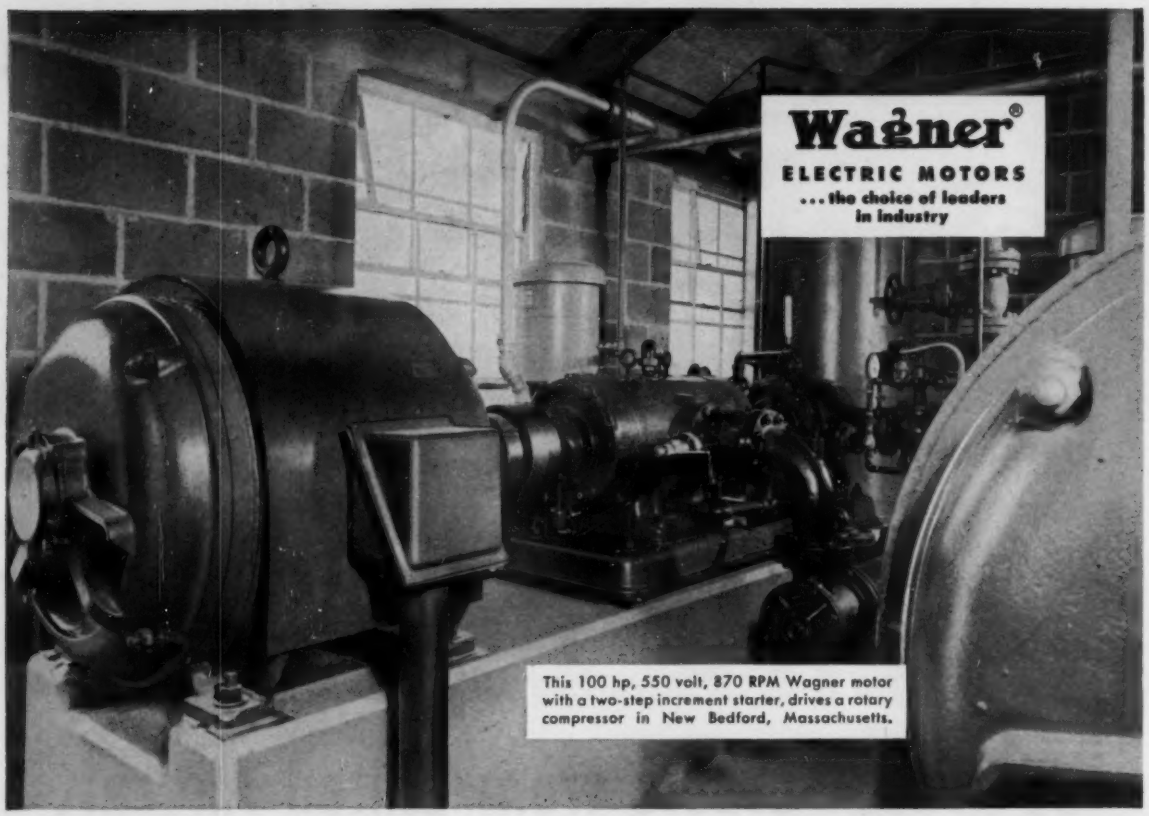
2131-B

SARCO

Sarco quality assures satisfaction

STEAM TRAPS • TEMPERATURE CONTROLLERS • HEATING SPECIALTIES





This 100 hp, 550 volt, 870 RPM Wagner motor with a two-step increment starter, drives a rotary compressor in New Bedford, Massachusetts.

Start large polyphase motors with minimum line voltage disturbance

USE THE Wagner INCREMENT MOTOR AND STARTER COMBINATION

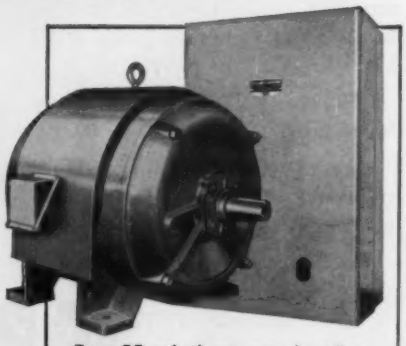
Here's a modern, economical, highly efficient way to start large polyphase motors — the Wagner Increment Motor and Starter "Package."

By reducing current drawn from the line on each point of the starter, the combination limits the inrush of motor current to values that are acceptable for the distribution systems of most power companies.

Voltage disturbances on the line are reduced because current taken from the line is not broken during the starting period—as it is when auto-transformers or compensator type starters are used.

Wagner two-step increment motor and starter combinations are suitable for most applications. For installations where unusually low inrush of starting current is desired, Wagner can furnish three-step and four-step increment starters.

Your nearby Wagner engineer will help you select the increment motor and starter combination that meets *your* requirement. Call the nearest of our 32 branch offices, or write us.



Type RP polyphase motor in ratings to 400 hp with increment type starter

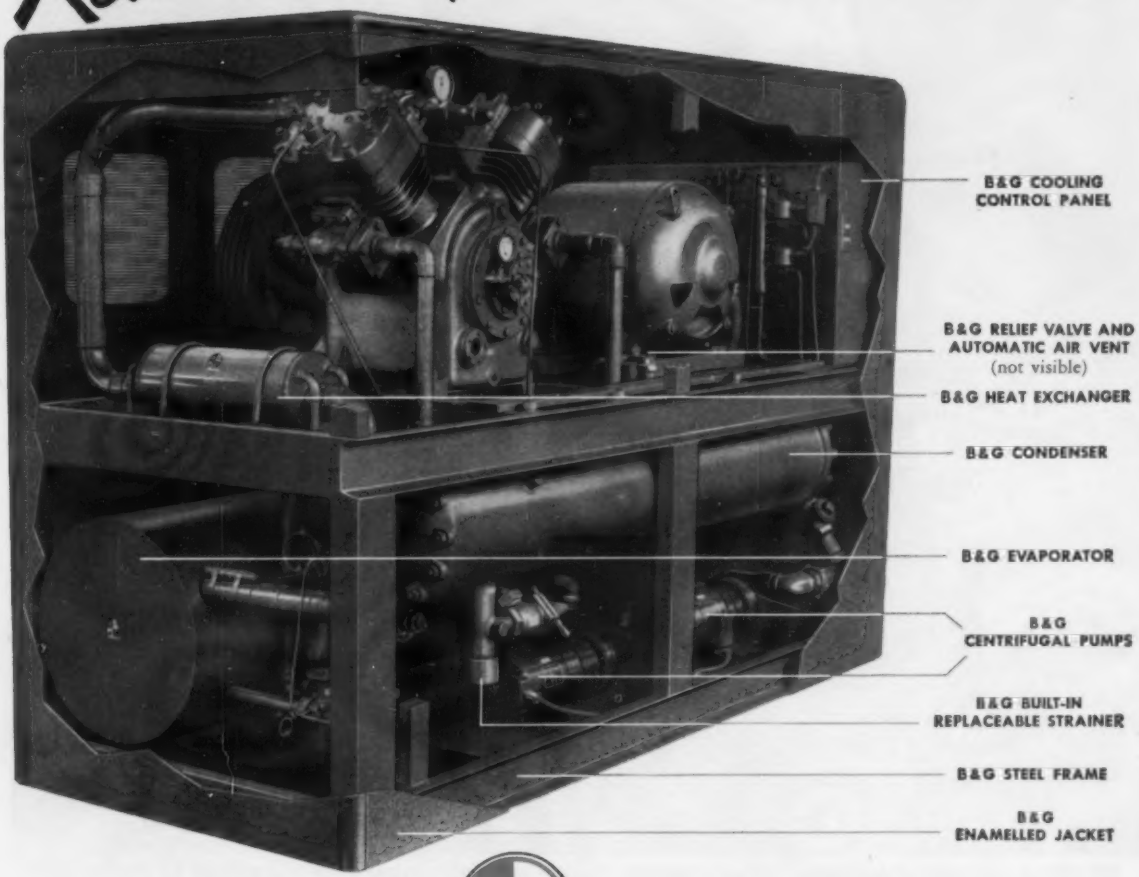
Wagner Electric Corporation
6370 Plymouth Ave., St. Louis 14, Mo., U.S.A.

See our exhibit at the 9th Exposition Air-Conditioning and Refrigeration Industry Atlantic City—Nov. 28 — Dec. 1 — Booth No. 237

M55-16

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE SYSTEMS-AIR AND HYDRAULIC

Revolutionary LIQUID COOLER



A COMPLETE B&G *Hydro-Flo*® UNIT...

An entirely new conception of a package liquid cooler! More features for efficient, trouble-free performance than you'd believe could be packed into one unit! Literally a plug-in unit for homes, apartments, hotels, commercial and industrial buildings and process work.

This is a B&G product . . . built to the high standards which make the B&G label a warranty of satisfaction. Many special features are incorporated as standard equipment which in similar products are "extras" or not available at all.

Consider just a few of the design highlights. The low pressure drop through the evaporator permits a substantial reduction in system pump sizes. Location of the evaporator under the compressor results in a lower center of gravity—easier to install and service. Non-recycling pump-down . . . and an integrated electrical control system which provides a high degree of automation without extra cost. Completely wired including chiller and tower pump . . . requires power supply only.

The B&G Package Liquid Cooler can be specified for a wide variety of applications . . . either as a separate space cooling unit . . . or in combination with a forced hot water system . . . or for the numerous industrial processes requiring controlled cooling of materials. Available in capacities from 7½ to 100 tons.

See the B&G PACKAGE LIQUID COOLER at Booths 519-20 Air Conditioning and Refrigeration Exposition

Get all the facts!

Bulletin HB-755 will give you the complete story of the B&G Package Liquid Cooler. Includes numerous application diagrams and specifications for combination heating and cooling systems.

*Reg. U. S. Pat. Off.

BELL & GOSSETT
COMPANY
Dept. REC-5, Morton Grove, Illinois

Canadian Licensee: S. A. Armstrong, Ltd., 1400 O'Connor Drive, West Toronto

NO LOSS of sales reported when Hess Brothers, Allentown, Pa., department store, installed this high pressure air conditioning system on its three upper floors. Linked with system already in use on lower floors, it points up the advantages of...

Kno-Draft High Pressure Air Diffusers

A neat solution to air conditioning a department store without disrupting sales was worked out by Carrier Corporation engineers for Hess Brothers, Allentown, Pa.

Key elements in the installation are Kno-Draft High Pressure Air Diffusers. These permit use of smaller than ordinary ducts, yet provide *draftless* air distribution and equalized temperature throughout the area. Built-in sound baffles assure quiet air delivery.

Installation was done in quarter sections on each floor simultaneously. Thus, only minimum rearrangement of selling space was necessary.

Dropped ceilings cover half the depth of ducts, giving them a shallow beam appearance. The Kno-Draft High Pressure Air Diffusers themselves are easily and quickly attached to the ducts.

Kno-Draft High Pressure Air Diffusion is one of the newest and most efficient methods of air conditioning. Connor engineers have prepared an authoritative 48-page textbook on the subject. Write on your letterhead for a copy of Bulletin K-33. Connor Engineering Corporation, Dept. G-115, Danbury, Connecticut.

see our catalog in ARCHITECTURAL FILE or write for copy

CONNOR

kno·draft®

high pressure air diffusers

Want control for Water Heaters or Heat Exchangers?

call POWERS

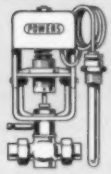
FLOWRITE
One of Powers Premium Quality Diaphragm Control Valves. They're simple, sturdy and dependable.

POWERS CONTROL

Over 60 Years of Temperature and Humidity Control

(c28a)

You Will Insure Better Temperature Control IF— you use the right type regulator and proper size control valve. Whether a simple self-operating regulator shown at left is required or the air operated controls featured here . . . you can get both types and others from Powers. For further information call or write our nearest office.



Powers ACCRITEM Temperature Regulator and FLOWRITE Valve—the right combination for many control problems where pressure and load conditions fluctuate widely, also for control of large size valves.

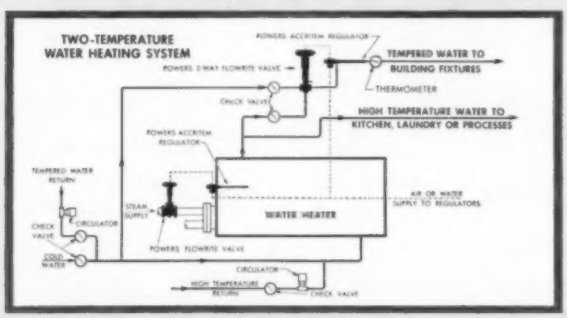
Over 50 Years Experience making this type of regulator

Control Point easily changed

Air or water operated

Ranges 50 to 250°F—150 to 350°F

VALVES: Available in a variety of body types and inner valves.

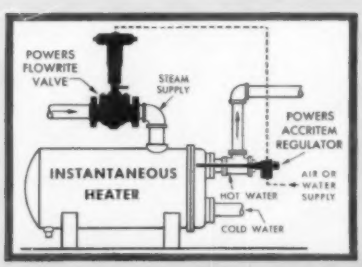


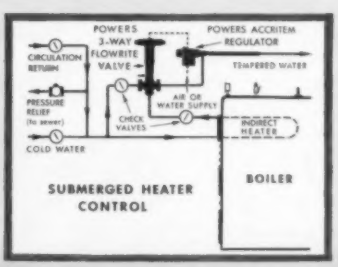
ACCRITEM TEMPERATURE REGULATOR

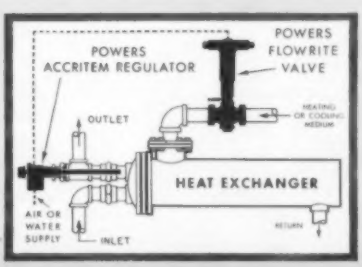
Gives Close Control and Years of Dependable Service.

- Has Adjustable Throttling Range and Calibrated Dial.
- Simple, Durable Construction assures years of trouble-free service.
- Easy to Install • Direct or Reverse Acting, reversible on the job.
- Small Size: Regulator head is 2⅞" wide, 3⅝" high, bulb is 12" long with ½" IPS Connection.

Fully Described in Bulletin 316. Write for a copy.







THE POWERS REGULATOR COMPANY | Skokie, Ill. • Offices in Chief Cities in U.S.A. Also Canada and Mexico • See your phone book

Simplicity and Good Design Features in

POWERS

FLOWRITE VALVES

STURDY, PRACTICAL DESIGN
Strong, light weight precision cast alloy housing is corrosion resistant. Only 6 bolts saves maintenance time.

OVER 60 YEARS
of Temperature and Humidity Control.

Ball Check Lubricator with Silicone grease for temperatures 40° to 500° F.

(b98)

give close control and they last longer

1. **Diaphragm** has a formed bead which provides increased sealing action with increasing control pressure. It has no bolt holes. Diaphragm lasts longer.

2. **Piston plate assembly** has a free floating thrust plate which absorbs side thrust. Closely guided piston plate maintains valve stem in accurate alignment. High tensile strength steel spring is cadmium plated and completely enclosed.

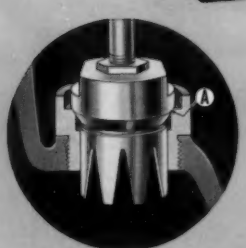
3. **Adjustment screw** is non-rising ball bearing type cadmium plated, easily accessible, easy to adjust.

4. **Packing:** Deep packing space contains preformed lubricated packing readily accessible. Note lubricator.

Accurate control results from smooth rolling diaphragm and minimum of valve stem friction.

Right type and size of valve is important for good control. An experienced Powers engineer will gladly help you make the right selection. Call our nearest office or write us direct.

For Pressures up to 250 PSI.



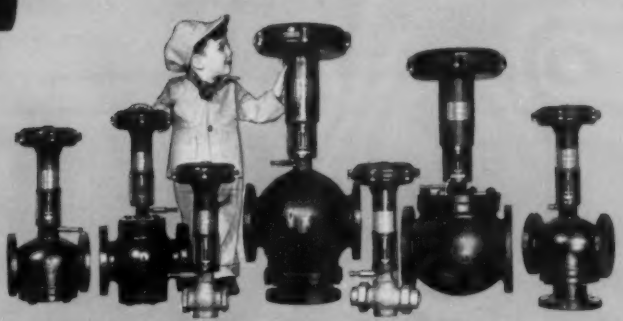
Renewable Stainless Steel, Disc and Seat.

Compare POWERS Single Seat Valves with other high quality valves. Check their performance, tight shut off feature and sturdy construction.

Available: Composition Disc also V-Port characterized which gives straight line control. Separate shut off seat (A) reduces wire drawing, insures tight shut off.

AT NO EXTRA COST
POWERS CONTROL SYSTEMS
Include these Premium Quality Valves

Get complete information, write for series 344 bulletins



SINGLE SEAT • DOUBLE SEAT • 3-WAY MIXING VALVES

Established 1891 **THE POWERS REGULATOR COMPANY** Skokie, Illinois

Offices in Chief Cities in U.S.A., Canada and Mexico, See Your Phone Book

Sell More Heaters

THERE IS A JOHN ZINK HEATER FOR EVERY HEATING NEED

Prospects don't walk away when you show JOHN ZINK Heaters — they buy! For both home and industry JZ Heaters offer customers just what they need in heating: automatically controlled even heat, fuel economy, utmost safety, and quiet operation. JZ Heaters are available in four popular models and many sizes — upright or horizontal CENTRAL HEATERS, louvre or radiant WALL HEATERS, UNIT HEATERS and FLOOR FURNACES. All JZ Heaters are AGA approved for natural, mixed or LP Gas.

Why JZ Heaters Are Money Makers

HIGH PROFIT — JZ Heaters bring a high margin of profit because less time is spent selling customers. JZ Heaters almost sell themselves.

EASY INSTALLATION — JZ Heaters are known for their ease of installation, takes only a short time when compared to other heating units.

EASY TO SERVICE — While compactly and sturdily built, all parts of a JZ Heater are easily accessible. Rarely are parts replacements needed.

JZ Heaters in Four Popular Styles

FLOOR FURNACES. JZ gas fired floor furnaces are available in five conventional and short models with input ratings from 30,000 B.t.u/hr. They become a complete one-package heating unit when equipped with safety pilot and automatic temperature control.

CENTRAL HEATERS. Available in Vertical or Horizontal forced air models. Can be installed in attic, closet, basement, utility room, under the floor, or as a suspended unit. From 65,000 B.t.u/hr.

UNIT HEATERS. Model UHS Gas-fired, fan type suspended heater. Completely automatic. Available in two styles, attractively finished, quiet, safe and easy to install. From 44,000 B.t.u/hr.

WALL HEATERS. WH-25 Recessed Wall Heater fits standard 2" x 4" stud partitions on 16" stud centers. Barely 58" high. Available in standard or radiant styles.

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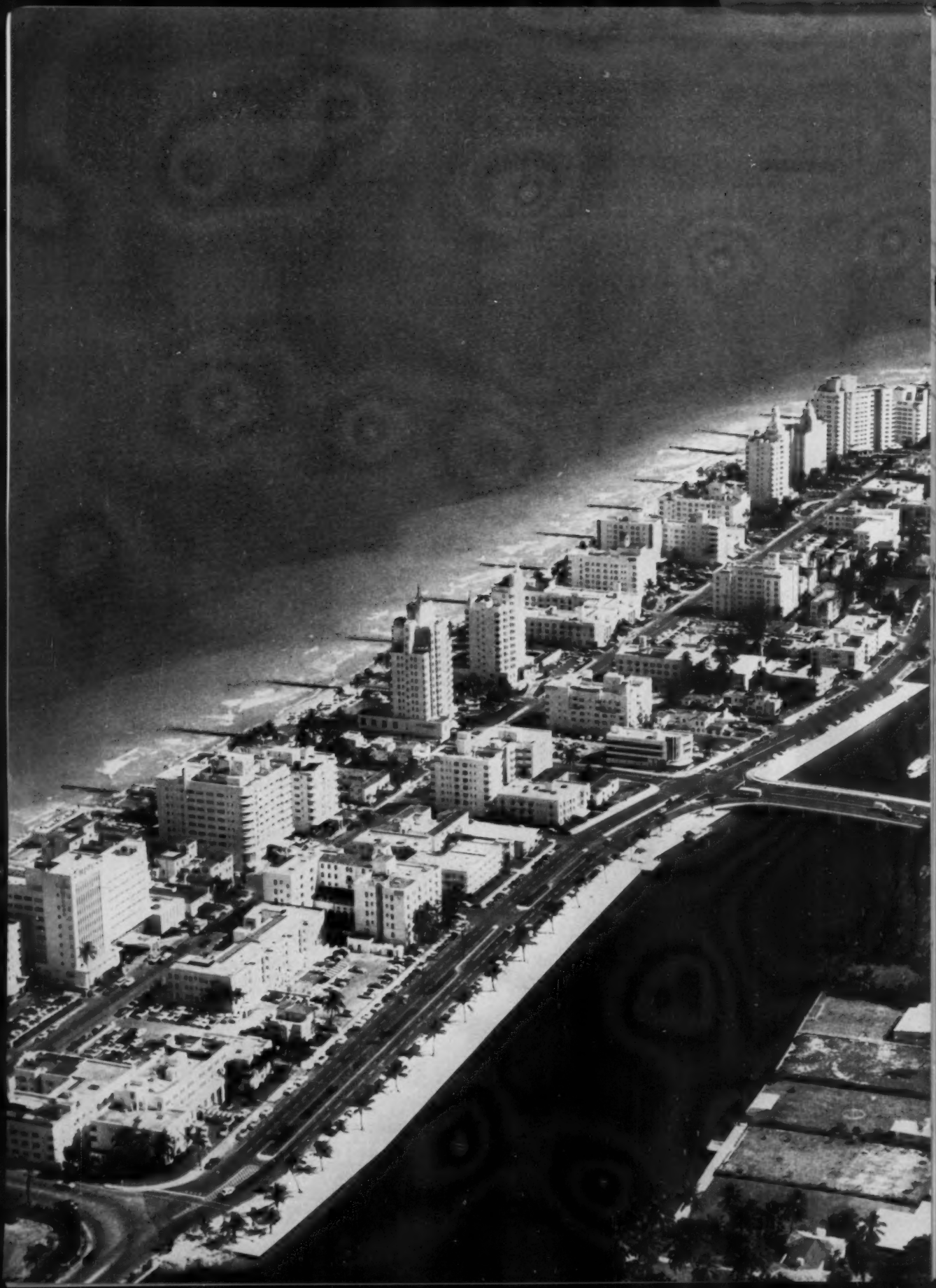
JOHN ZINK COMPANY

4401 South Peoria Tulsa 5, Oklahoma



IT'S ALWAYS "FAIR WEATHER" IN MIAMI'S 50 FINEST... WITH JENN-AIR EXHAUSTERS

This is Miami . . . America's plush and popular playground. Its hotels play host to the most discriminating and discerning guests—the famous, the critical, and every-day people from everywhere. They come to buy Miami's main commodity, WEATHER. They expect it to be perfect inside and outside; that is, on the beaches and in the hotels as well. Perfect weather inside means perfect ventilation. That's why 50 of Miami's top-flight hotels and motels chose Jenn-Air Exhausters . . . They met 3 vital tests: *Beauty—Plus Function*—Exhausters had to blend with the structural motif of the hotels—keep roof lines low and attractive . . . for exhausters, too, had to be part of the panoramic view. Jenn-Air low-contour design met the test here. *Dependability*—Twin devils . . . salt air and sand . . . are ceaselessly at work behind the gentle exterior of Miami weather. Made of ageless aluminum, Jenn-Air Exhausters resist both to assure uninterrupted and dependable service. *Quiet Operation*—The complete power unit of a Jenn-Air Exhauster is floated in neoprene rubber. There's no metal to metal contact, which means vibration is reduced. This adds up to quiet operation. Jenn-Air Wall and Roof Exhausters are produced in a wide range of sizes to meet most ventilating problems. Consult your local Jenn-Air Specialist in the pre-planning stage.

JENN-AIR PRODUCTS COMPANY, INC.
1102-08 Stadium Drive • Indianapolis 7, Indiana

Hotel Fontainebleau. Architect: Morris Lapidus / Consulting Engineer: Bruce Jacobi / Ventilating Contractor: Hill-York Corporation

Bal Harbor Hotel. Architect: R. E. Collins / Consulting Engineer: E. A. Hussar, Jr. / Contractor: C. R. Clark Co.

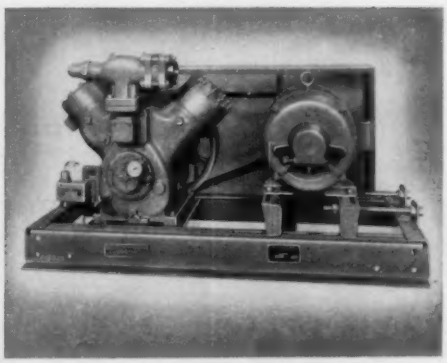
Balmoral Hotel. Architect: Carlos B. Schoeppl / Consulting Engineer: Sasnett Engineering Co. / Ventilating Contractor: Industries, Inc.

(Left) Low-contour Roof Exhausters, blend with architectural design; (center) Wall Exhausters, architecturally sculptured button design; (right) Belt Drive Centrifugal Roof Exhausters, capacity up to 13,000 CFM.

THE STERLING, MIAMI BEACH'S NEWEST ocean front hotel, enjoyed a banner first season last winter. Owner David Rosner assigns a good share of the credit to his Worthington-engineered air conditioning system which cools the 142 rooms and 186,000 cubic feet of dining and lobby space. "Maintenance service (routine checkups) couldn't be better," says Manager Sam Rosner, with an eye on the potential business losses (running into thousands of dollars) that might follow mechanical breakdown. System includes both central and packaged air conditioners.

Worthington teams central and packaged air conditioners to cool new Miami Beach hotel

3-TON, 7½-TON, AND 15-TON PACKAGED AIR CONDITIONERS with the famed Freon compressor like this serve as booster units to keep Sterling's crowded bar, television and card rooms cool without over-cooling other areas. Write for facts to Worthington Corporation, Air Conditioning and Refrigeration Div., Section A.5.66-HP, Harrison, N.J.



BASIC AIR CONDITIONING UNIT for the Sterling Hotel is this 60-ton Worthington Freon compressor, end product of a million-dollar research program. Worthington equipment includes two Freon compressor units, three packaged air conditioners, and one shell and tube condenser. And Worthington's special cut-off system keeps power costs low when only minimum temperature changes are required. A.5.66

WORTHINGTON

Climate Engineers to Industry, Business and the Home

It's tough—for a copywriter—to see this white space going to waste. But it sure tells a story! Let this entire page represent the area of plain tube required for your heat transfer. The same heat transfer surface can be concentrated in relatively the space occupied by this block of type by using Wolverine Trufin*—the integral finned tube. Trufin boosts capacity—saves space—cuts costs. Send for Trufin Catalog.

*REGISTERED U.S. PATENT OFFICE

WOLVERINE TUBE

DIVISION OF CALUMET & HECLA, INC.

1461 CENTRAL AVE. DETROIT 9, MICH.

Wolverine Trufin is available in Canada through the Unifin Tube Company, London, Ontario

Modine Convectors
30 types, 8000 sizes
There's a Modine Convector to meet your exact needs: Deluxe, standard and institutional models—free-standing, fully and partially recessed, concealed and wall-hung types with many design variations. Model shown above is a Type F, fully recessed.

Smartest buy—three ways!

1. IMPROVE ROOM APPEARANCE

Modine Convectors replace unsightly radiators . . . lend smooth, classic-modern appeal to every room. And they're finished to "take" paints that match any decor. Also, Modines retain "new look" for years because of special bonderizing process.

2. INCREASE OCCUPANT COMFORT

Modine Convectors assure gentle circulation of warm air. There are no drafts, no hot spots near the convector, no cold spots in the far corners. And, because they are individually controlled, they can easily be set to suit the occupant's express wishes.

3. SAVE THE BUYER MONEY

Considering the many advantages they offer, Modines are remarkably low priced. And—they offer years of efficient, inexpensive heating at nominal cost for maintenance. Each Modine, regardless of its price bracket, is craftsman built with quality materials.

R-1289

For complete details, contact the Modine representative listed in the classified phone book or write Modine Mfg. Co., 1509 DeKoven Ave., Racine, Wis.

Modine
CONVECTOR RADIATION

BELOW: *Among the many features of the lobby are the clerestory illumination, the unobtrusive air diffusers, and the bas relief mural carved in wood by Buck Winn, Jr.*

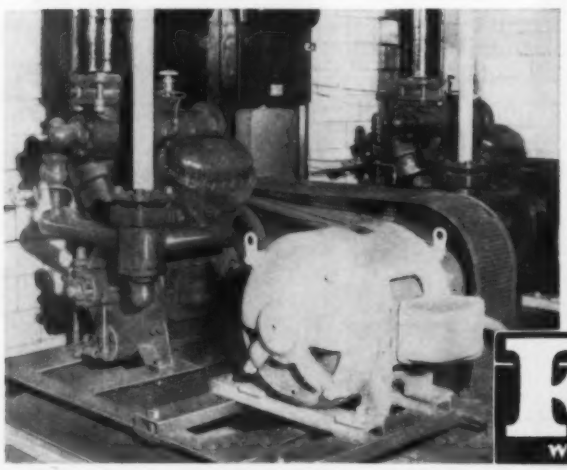
Architects: Prinz and Brooks
General Contractor: Burgher Construction Co.

The New Look In

• Architecture
• Air Conditioning

The Oak Cliff Savings and Loan Association started eight years ago with $35,000—now has resources of $30,000,000. Its new building at Bishop and Center Streets is one of the finest in Dallas, and was awarded first honors for non-residential construction in 1954 by the Texas Society of Architects.

The entire structure, including the lobby, conference and accounting areas, community room and lounge, is air conditioned with two Frick "ECLIPSE" compressors. Each refrigerating machine is driven by a motor of 40 horsepower.



When you want the ultimate in quality and dependability . . . whether for air conditioning, refrigeration, ice making or quick freezing . . . specify FRICK.

Get quotations now on the equipment you need: Branch Offices and Distributors in principal cities, the world over.

DEPENDABLE REFRIGERATION SINCE 1882

FRICK CO.

WAYNESBORO, PENNA. U.S.A.

The Swing is to...

FILTR-AIRE

Permanent Type

ELECTRO STATIC FILTERS

A SIZE FOR EVERY TYPE AND SIZE OF AIR HANDLING EQUIPMENT

1/2", 1", 2" Thicknesses

The Amazing DRY Filter that meets the requirements of professional engineers

1/2", 1", 2" Thicknesses

TIME TESTED Natural Hair Media treated with the new miracle SARAN makes possible a light weight low-density filter of extraordinary efficiency and long life.

FILTR-AIRE does the job better from the moment of installation.

First, you get really good filtering action, tremendous dust holding capacity, and integral loading. Second, the cost is reasonable. Third, maintenance is easy and fool proof. You simply hose to clean. No oil to apply. No mess. No explosion hazards. No expensive down time.

All FILTR-AIRE Filters are approved for Government Installations.

FILTR-AIRE
PERMANENT ELECTRO-STATIC WASHABLE FILTERS

Engineered for Engineers

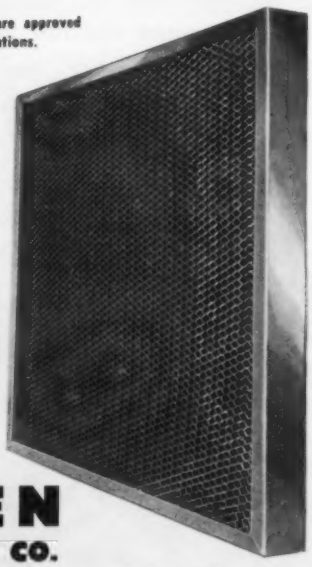
A. C. Products, Inc. 3 Ways Better . . . and Here's Why:

1. **A GOOD MEDIA**—Natural, rough hair, of course, provides efficient filtration, but that's just the beginning of the FILTR-AIRE story.
2. **A SUPERB BONDING AGENT**—Miracle SARAN enhances the desirable features of natural hair and supplies many of its own. SARAN-treated, natural media of always uniform density exerts an increased electrostatic attraction for dust particles, making possible lower resistance, integral loading, and greater holding capacity, even when air is not in motion. What's more, SARAN sheds dust and dirt with water, making this filter completely water washable. SARAN is accident proof, too . . . will never flame or flair up.
3. **EXCELLENT FRAMING, GRILL and CONSTRUCTION** Tough, light, extruded Aluminum frames, aerodynamically designed grill of strong copper bearing, galvanized metal lath, make FILTR-AIRE filters readily accessable. Easy to change. Easy to wash.

Distributor Territories Available

GET THE FACTS TODAY

Write for brochure and engineering data.

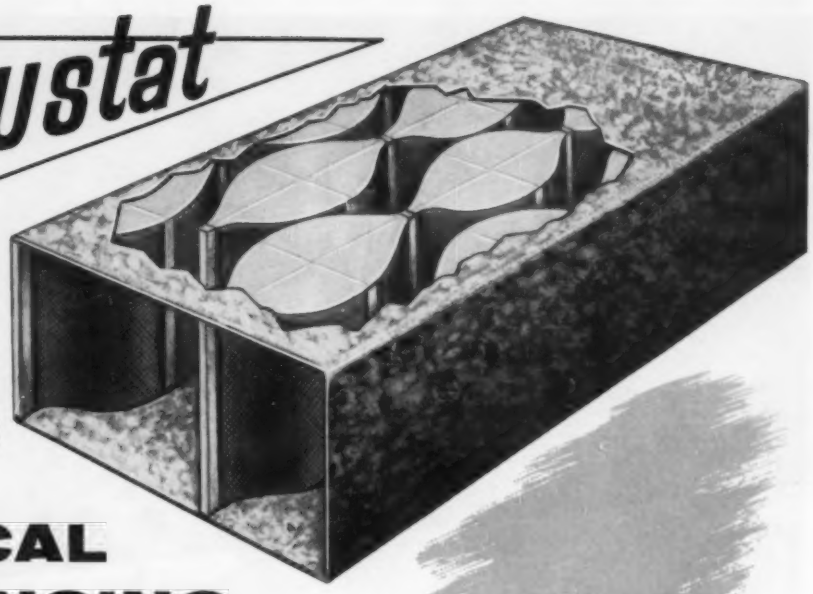


National Representative

PEDEN EQUIPMENT CO.

4512 Mt. Vernon Houston, Texas

Aircoustat



PRACTICAL SILENCING

for AIR CONDITIONING SYSTEMS

Aircoustat is a compact, *completely packaged* unit for silencing fan and air noise in air conditioning systems. Easily installed directly into the duct work, Aircoustat eliminates the need for costly, extensive duct lining. And results are astonishing: one *7 foot* unit reduces noise level below what *100 feet* of commercial duct lining could accomplish.

Engineered to provide broad band attenuation with low pressure drop, Aircoustat is available in 14 standard sizes for use with all styles and sizes of duct, and 8 types to meet any desired conditions. Selection is no problem: ***if it fits geometrically, it fits acoustically.***

Where to install Aircoustat

Aircoustats are incorporated as part of the duct work. If only selected areas require quiet, install above individual diffusers.

Where entire system is to be silenced, insert Aircoustat between fan and first length of duct. For areas requiring special silencing, two Aircoustats may be joined in series.

How to install Aircoustat

Aircoustat requires no special tools for installing. It is constructed to be joined to ductwork with a lock seam.

If ductwork and Aircoustat differ in size, a canvas or asbestos coupling may be used. If ductwork is hung, support Aircoustat similarly.

Mail this coupon TODAY ▶▶▶

SILENCE SERVICE

Industrial Sound Control Inc.
45 Granby Street, Hartford 12, Conn.

INDUSTRIAL SOUND CONTROL, INC.
45 Granby St., Hartford 12, Conn.
Please send me more information on AIRCOUSTAT.

NAME .....
TITLE .....
COMPANY .....
ADDRESS .....
CITY ..... ZONE ..... STATE .....

Radiant Heating Used to Provide Maximum Comfort for Cerebral Palsy Patients

A complete radiant heating system of USS National Steel Pipe has been installed at the Walter D. Matheny School for Cerebral Palsy Children, Peapack, N. J., to insure heating comfort for the patients and to keep operating costs of the institution at an efficient low.

The majority of the pipe used in private rooms was ¾-inch standard. Supply mains through the hallways were laid in sizes up to 2 inches diam.

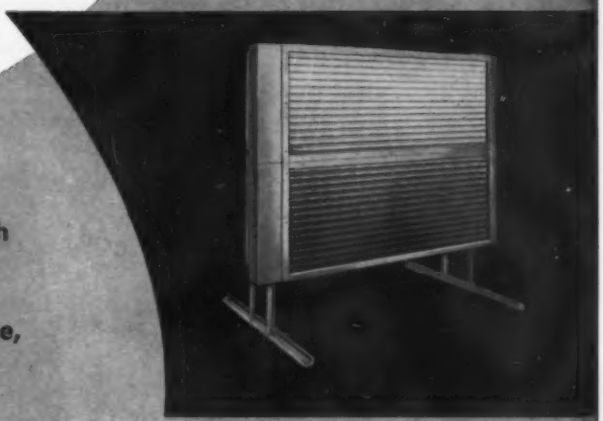
In installations such as this, where dependability, efficiency and economy are the prime considerations, architects and contractors almost inevitably turn to National Pipe. They have been specifying National, in fact, for over 60 years as the "standard" for conventional plumbing and heating systems. And why not? National Steel Pipe has every characteristic necessary to meet the requirements of such applications—smooth, uniform bending; sound, strong welding properties; and long service life. These are the characteristics that have made National the largest selling pipe in the world.

Write *now* for complete details on the use of USS National Steel Pipe for radiant heating and snow melting applications. Ask for Bulletin No. 19. And keep National in mind for your next installation.

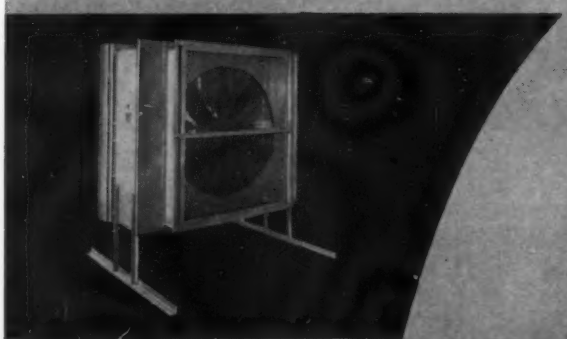
NATIONAL TUBE DIVISION, UNITED STATES STEEL CORPORATION, PITTSBURGH, PA.
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

STOP *using water!*

Eliminate all water problems with UNICON by KRAMER. Any size compressor, regardless of tonnage, can be air-cooled with UNICON.



KRAMER **UNICON**

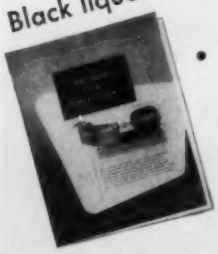


Stands, hoods, and wind deflectors are available for simplified outside mounting
You need nothing else!

WRITE FOR BULLETIN U-210C

KRAMER TRENTON CO. • Trenton 5, N.J.

• Calcium chloride brine • Flushing liquor
Sodium sulphate • Asbestos fiber & cement mix • Green liquor •
Soap solution • Grinder coolant • Carbon slurry • Cane wash • Salt brine • Sea water •
• Caustic solution • Bleach liquor • Grape juice concentrate • Tomato juice concentrate •
Tomato puree • Propanol • Soap liquor • Cane juice • Aqueous lime • Coke oven oil •
• Paper stock • Waste sulphite liquor • Alkylaryl sulfonate • Sugar liquor • Vinyl pyridine
• Saturated brine • Grape juice • Tomato juice • Press liquor • Calcium bisulphite • Melt
Phenolized ammonia • Ammonia liquor • Sulphuric acid • Paraffine oil and water • Sludge
• Milk waste • Gritty water • Cane syrup • Lime & soda solution • Cachaza • Clear juice
White water • Mineral oil • Chromic acid Cement • Gasoline • Depanol
Brine • Vegetable oil • Licorice liquor • Flume water •
• River water • Benzine thinner • Mash
Methylene chloride • Sodium hydroxide
Sizing solution • Alcohol •
• Steep soda • Caustic soda
Black liquor • Ethylene glycol
• Fuel oil • Furfural
• Condensate •

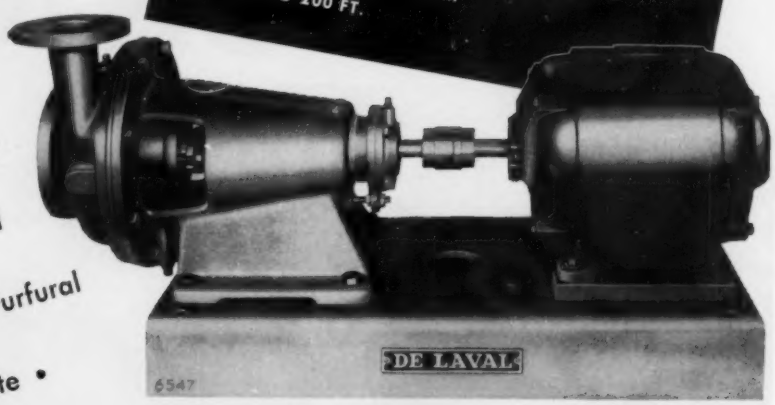


WRITE FOR BULLETIN 1125-B

One pump handles all these liquids...

DE LAVAL CPO PROCESS PUMP

CAPACITIES TO 2,000 GPM
HEADS TO 200 FT.



DE LAVAL *Centrifugal Pumps*

DE LAVAL STEAM TURBINE COMPANY
871 Nottingham Way, Trenton 2, New Jersey

DL-281

West Charlotte Senior High School, Charlotte, N. C.
Graves & Toy, Architects.
Mechanical Engineers Inc., Heating Engineers.

Youngstown's Yoloy Pipe is shown in the process of being installed. In a radiant heating system like this, the pipe must be good as it's put there to stay.

YOUNGSTOWN YOLOY PIPE chosen for radiant heating system at West Charlotte High School

This handsome school won a First Award in the 1955 School Executive magazine competition. It also won an A.I.A. Award of Merit. Justifiably, too, as it is the result of years of planning by a group of Charlotte's educators and architects.

How fitting that far-sighted civic leaders like this chose Youngstown's Yoloy Pipe for the radiant heating system. For, Youngstown Yoloy is a low alloy steel that is especially resistant to corrosion and shock. Made only of the finest steel, with additions of nickel and copper to give it those desirable extra qualities. Youngstown's Yoloy Pipe is controlled by its sole producer from ore mine to the final operation. Yoloy Continuous Weld Pipe is used most economically in many industrial and snow removal systems as well as in train pipe installations.

Having problems?

For further information write for our free booklet "The ABC of Yoloy Continuous Weld Pipe and its corrosion resistance".

Youngstown

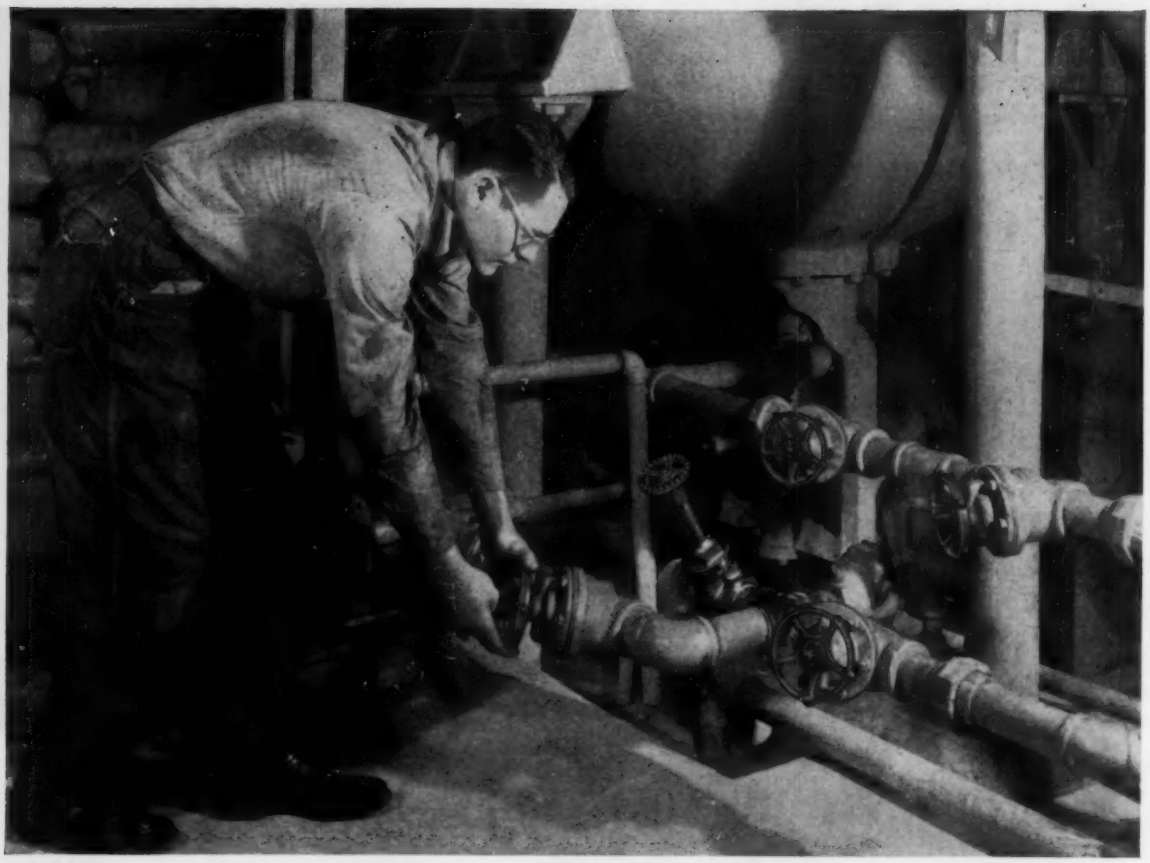
QUALITY V YOUNGSTOWN SERVICE

THE YOUNGSTOWN SHEET AND TUBE COMPANY

Manufacturers of Carbon, Alloy and Yoloy Steel

General Offices Youngstown, Ohio District Sales Offices in Principal Cities.

SHEETS - STRIP - PLATES - STANDARD PIPE - LINE PIPE - OIL COUNTRY TUBULAR GOODS - CONDUIT AND EMT - MECHANICAL TUBING - COLD FINISHED BARS - HOT ROLLED BARS - WIRE - HOT ROLLED RODS - COKE TIN PLATE - ELECTROLYTIC TIN PLATE - BLACK PLATE - RAILROAD TRACK SPIKES - MINE ROOF BOLTS



Heavy fluids can't hinder working parts in these CRANE VALVES

THIS CASE HISTORY tells how the United States Playing Card Co., Cincinnati, solved—with Crane Diaphragm Valves—a costly problem of piping heavy enamels for paper coating.

The trouble was in the plug cocks and conventional gate valves formerly used in the enamel lines. During normal shutdowns the heavy liquid would build up on seating surfaces, in stem threads and working parts. The cocks and gates would "freeze up" . . . were hard to operate . . . couldn't be shut tight. The condition hampered production . . . made floors messy and dangerous . . . pushed maintenance costs sky-high.

Replacing with Crane Packless Diaphragm Valves stopped the trouble completely. Their sealed-to-fluid bonnet and pliable neoprene disc insert did the trick. After more than 4 years, all 48 Crane valves installed—with no maintenance whatsoever—are still seating tight . . . still operating freely and smoothly.

CRANE PACKLESS DIAPHRAGM VALVES

Working parts are safely out of contact with line fluid. The diaphragm seals the bonnet—that's all it does, giving it longer life. The independent disc with pliable insert seats tightly on foreign particles or seat deposits . . . and controls fluid, even should diaphragm fail. See your Crane Catalog or Crane Representative for wide selection of body, bonnet, and trim materials in these valves for countless uses.

CRANE CO.

General Offices: 836 S. Michigan Ave., Chicago 5, Illinois
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • KITCHENS • PLUMBING • HEATING

CRANE'S FIRST CENTURY . . . 1855-1955

He's making it better with Bethcon

He's fitting a side panel into the air-mixing chamber of a large municipal auditorium's air-conditioning system. This chamber, as well as all of the other sheet-metal work in the system, was fabricated of Bethcon continuously galvanized steel sheet.

The reason for selecting Bethcon for this job lies in the superior zinc coating made possible by the continuous process. This process bonds the zinc coating more tightly to the sheet than the ordinary hot-dip method, thus putting an end to peeling or flaking under extreme forming conditions.

The coating is more uniform, too, because continuous galvanizing distributes the zinc more evenly over the entire Bethcon sheet. Heavy beads usually found on the drip ends of galvanized sheets are conspicuously absent on Bethcon. And the distinctive spangles on Bethcon sheets are bright, uniform and attractive in appearance.

Bethcon is made in sheets or coiled strip, 16-gage or lighter. Either plain or copper-bearing steel can be used for the base metal, depending on your requirements. Any Bethlehem district office will gladly furnish whatever additional information you may desire.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation.

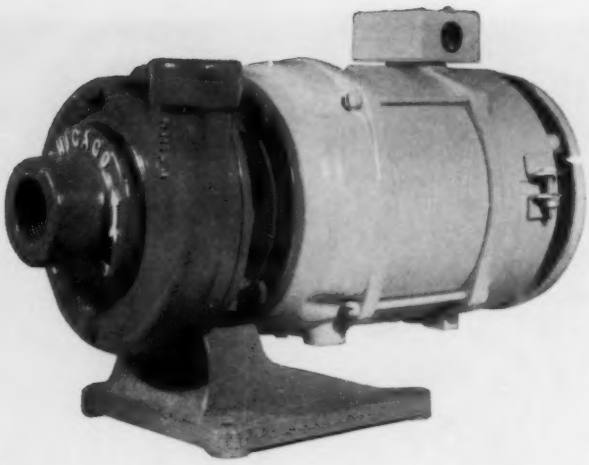
BETHLEHEM STEEL

BETHLEHEM STEEL

C-C

CLOSE-COUPLED

PUMPS*



All Pumps in stock

Shipped same day order received

TYPICAL C-C SERIES PUMP APPLICATIONS ARE:

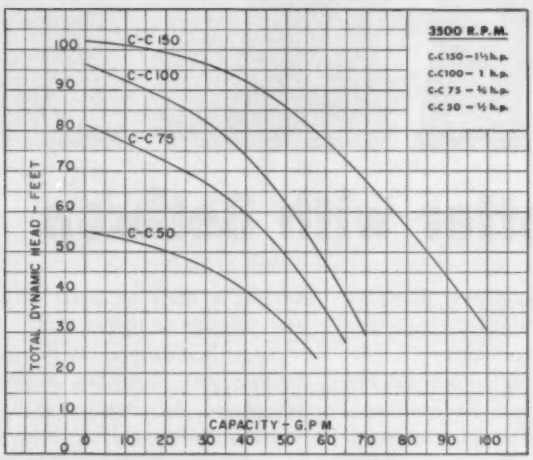
Cooling Towers • Air Conditioning

Chilled Water Circulating

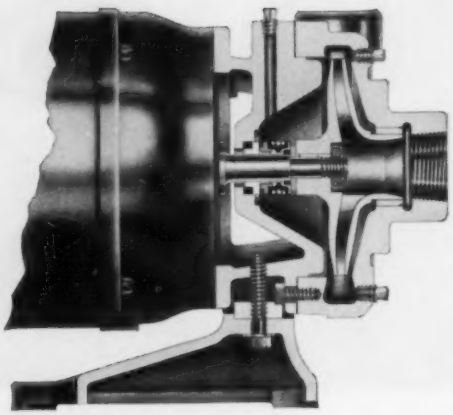
Hot Water Circulating

Pneumatic Water Systems

Booster Systems



*For cooling towers, etc.



C-C Series pumps are equipped with a Leak-Proof "Chicago Mechanical Seal". Each pump operates over the entire range of its curve quietly and smoothly without motor overload. Write to Department B for Bulletin 108-G.

fmc FOOD MACHINERY AND CHEMICAL CORP.

CHICAGO PUMP COMPANY

Subsidiary of Food Machinery and Chemical Corporation

BUILDING PUMP DIVISION

622 DIVERSEY PARKWAY • CHICAGO 14, ILLINOIS

Condo-Vac ®, Sure Return ®, AVC, LVC, Fire, House & Circulating Pumps, Pneumatic & Tankless Water Systems . . . Flush Kleen ® Sewage Ejectors, Little Giant ® & Non-Clog Bilge Pumps, Pumps for every Industrial use.

POWELL VALVES . . . THE COMPLETE QUALITY LINE . . . POWELL VALVES

. . . THE COMPLETE QUALITY LINE . . . POWELL VALVES . . . THE COMPLETE QUALITY LINE . . .

. . . THE COMPLETE QUALITY LINE . . . POWELL VALVES . . . THE COMPLETE QUALITY LINE . . .

Preferred for Precision and Performance

FIG. 560—Bronze Regrindable Horizontal Swing Check Valve for 200 Pounds W. S. P.

Powell Valves are the choice of engineers because they know every valve is precision made, meeting every specification—every time.

And there are other good reasons why engineers prefer Powell Valves—because Powell Valves are dependable . . . economical . . . and Powell has the COMPLETE quality line of valves.

Consult your Powell Valve distributor. If none is near you, we'll be pleased to tell you about our complete line, and help solve any flow control problem you may have.

The Wm. Powell Company
Cincinnati 22, Ohio . . . 109th year

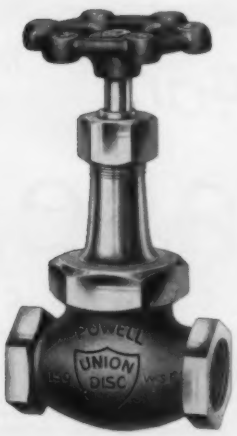


FIG. 150—Bronze Vulcanized Composition Disc Globe Valve for 150 Pounds W. S. P.

FIG. 500—Bronze Screwed-in Bonnet Gate Valve for 125 Pounds W. S. P.

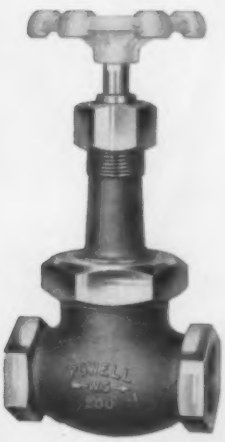


FIG. 2608—Bronze Full Flow Globe Valve for 200 Pounds W. P.

POWELL VALVES

FAST SERVICE FOR STAINLESS STEEL IS CHASE'S SPECIALTY!
Chase Warehouses and Sales Offices stand ready to rush you the type, size and quantity of stainless steel tubing or pipe you need. You get the same kind of dependable service that has made Chase the nation's headquarters for brass and copper. Call Chase *today* for stainless steel.
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STAINLESS
STEEL
pipe and tubing
FAST
from
Chase
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WATERBURY 20, CONNECTICUT • SUBSIDIARY OF KENNECOTT COPPER CORPORATION
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Albany† Atlanta Baltimore Boston Charlotte† Chicago Cincinnati
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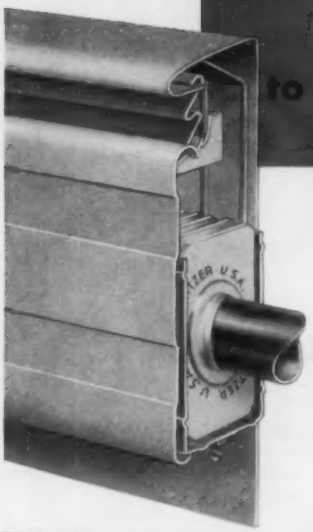
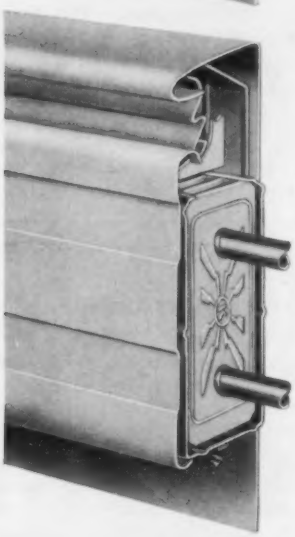
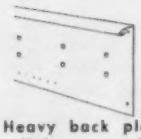
New York Philadelphia Pittsburgh Providence Rochester† St. Louis
San Francisco Seattle Waterbury (†sales office only)

ONLY *Installed cost* tells the full profit story...
to give extra QUALITY with MOST PROFIT...

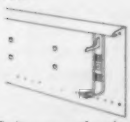
use KRITZER



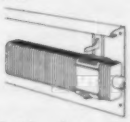




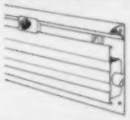
1. Heavy back plate nailed or screwed to wall.



2. Coil supporting brackets snapped into position.



3. Guide shoe slipped over coil. Laid in position on brackets.



4. Damper put in place. Front cover snapped on. Damper control snapped into position. NO SCREWS OR BOLTS USED AFTER BACK PLATE.

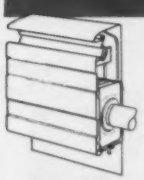
"K" LINE Radiant Baseboard

Naturally the basic cost of KRITZER Baseboard is slightly higher than ordinary baseboards. The best materials and workmanship are employed in its manufacture . . . and the "pre-fabricated" features provided by KRITZER engineering make "K" Line design layouts and installations the easiest and quickest of any baseboard. With installation time considerably reduced, highest quality heating installations are yours with a full profit margin and no higher price to your customer.

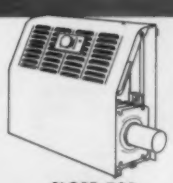
Users are always pleased with such KRITZER built-in features as the clean, modern appearance with safe, rounded corners and edges; the guide shoe which assures quiet operation and prevents damage to coils and eliminates "call backs"; and the efficient heating from laboratory tested KRITZER coils (ratings Certified).

For your protection all KRITZER products are guaranteed for materials, workmanship, and heating capacity. You can learn all about the "K" Line in BULLETIN 200. Write today to KRITZER RADIANT COILS, INC., 2901 Lawrence Ave., Chicago 25.

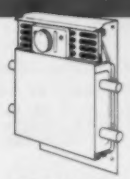
KRITZER QUALITY HEATING PRODUCTS



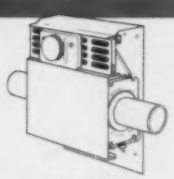
"K" LINE BASEBOARD



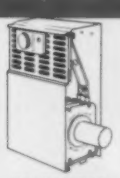
SLOPE TOP BASEBOARD



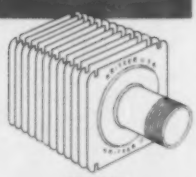
STANDARD BASEBOARD



UNIVERSAL BASEBOARD



CONVECTOR, SLOTTED FRONT



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KRITZER

REPRESENTATIVES IN PRINCIPAL CITIES

SEE YOUR JOBBER FOR KRITZER PRODUCTS

"IF IT'S KRITZER, IT'S RIGHT, SIR!"

Four good reasons why these new AMERICAN-Standard gas-fired boilers are best for your heating jobs

They're neater, better looking! ***They're lower, more compact!*** ***They're expandable, more versatile!*** ***They're easier to install and service!***

Both the G-4 and G-6 boilers are approved by A.G.A. for all gases and comply with A.S.M.E. specifications.

MODERN in design throughout with attractive 20-gauge steel jackets, these brand-new, space-saving boilers with built-in drafthoods, are ideal for large homes, apartments, schools, office buildings and commercial buildings. They also incorporate many engineering and construction features which make for higher operating efficiency . . . as well as installation and servicing economies. Some of these advantages are listed below.

G-4

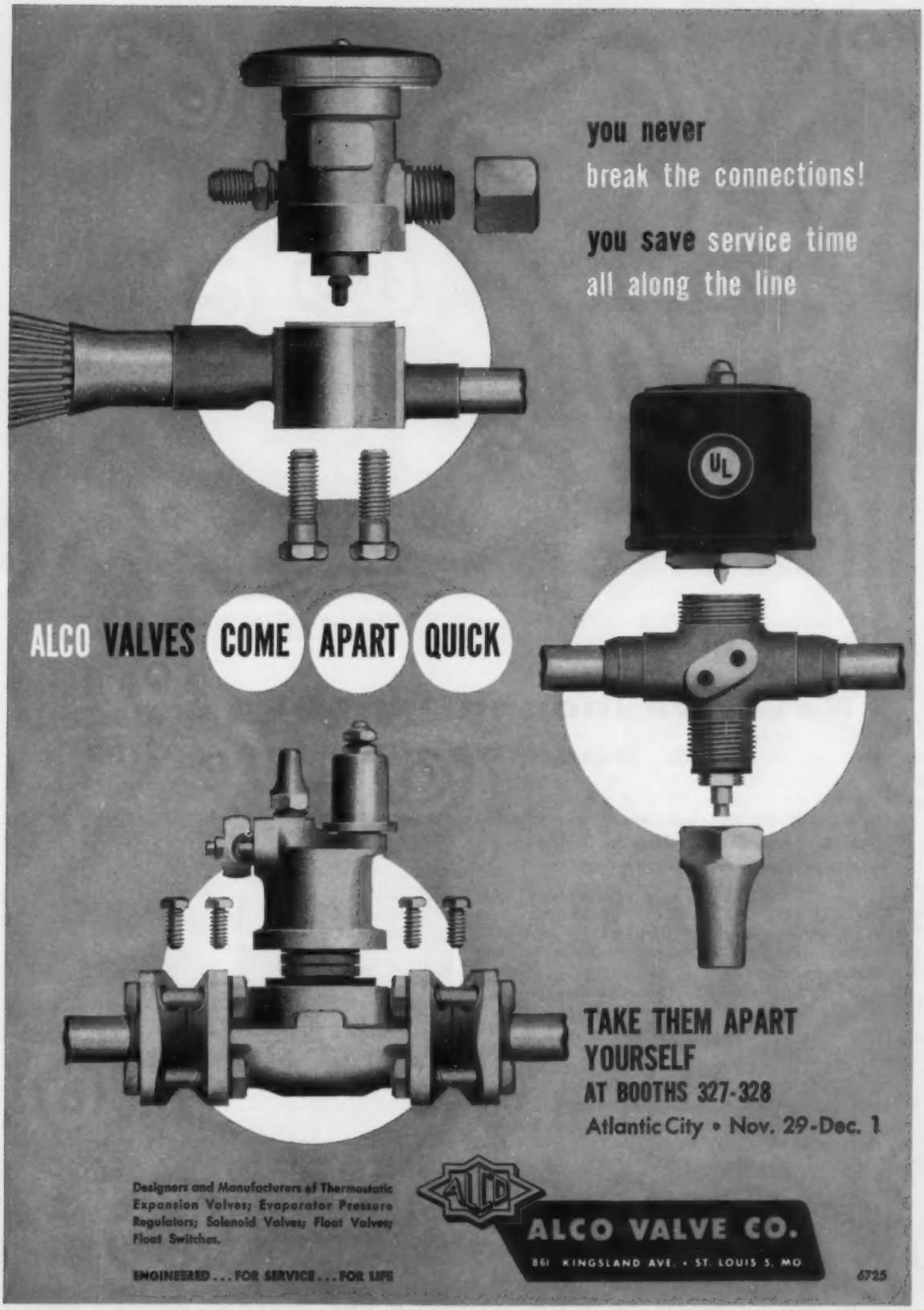
- For water or steam . . . available from 4 to 11 sections with inputs from 180,000 to 600,000 Btu per hour.
- Design based on use of multiple sections with burner for each flue passage. Factory tested burner has an input of 60,000 Btu per hour.
- Sections easily assembled . . . end sections designed with extended base to form supporting legs. Jacket encloses canopy, manifold and controls. Can be assembled after heating piping is in place.
- Pintype boiler sections—over 600 pins on each center section. Easily removed cleanout panel allows access to boiler sections without removing jacket.

G-6

- For water or steam. Available from 6 to 41 sections with inputs from 650,000 to 5,200,000 Btu per hour.
- Pintype projections—over 1200 on each center and intermediate section give heating area usually found only in much larger flat-surfaced sections. Multiple section design permits almost exact sizing of boilers to meet widest range of installations.
- Various tapping arrangements allow maximum flexibility in system piping. Smart looking jacket may be assembled after heating piping is installed. Removable access panels make boiler easy to service.
- Cast-iron base firmly supports boiler sections and burners. Facilitates installation.
- Manifold is factory assembled and rigidly fastened to base by cast-iron clamps.

For a more detailed description of these boilers, just contact your distributor or the nearest American-Standard Sales Office. Plumbing and Heating Division of American Radiator & Standard Sanitary Corporation, P. O. Box 1226, Pittsburgh 30, Pennsylvania.

AMERICAN-Standard
HOT WATER HEAT


you never
break the connections!
you save service time
all along the line
ALCO VALVES COME APART QUICK
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TAKE THEM APART
YOURSELF
AT BOOTHS 327-328
Atlantic City • Nov. 29-Dec. 1
Designers and Manufacturers of Thermostatic Expansion Valves; Evaporator Pressure Regulators; Solenoid Valves; Float Valves; Float Switches.
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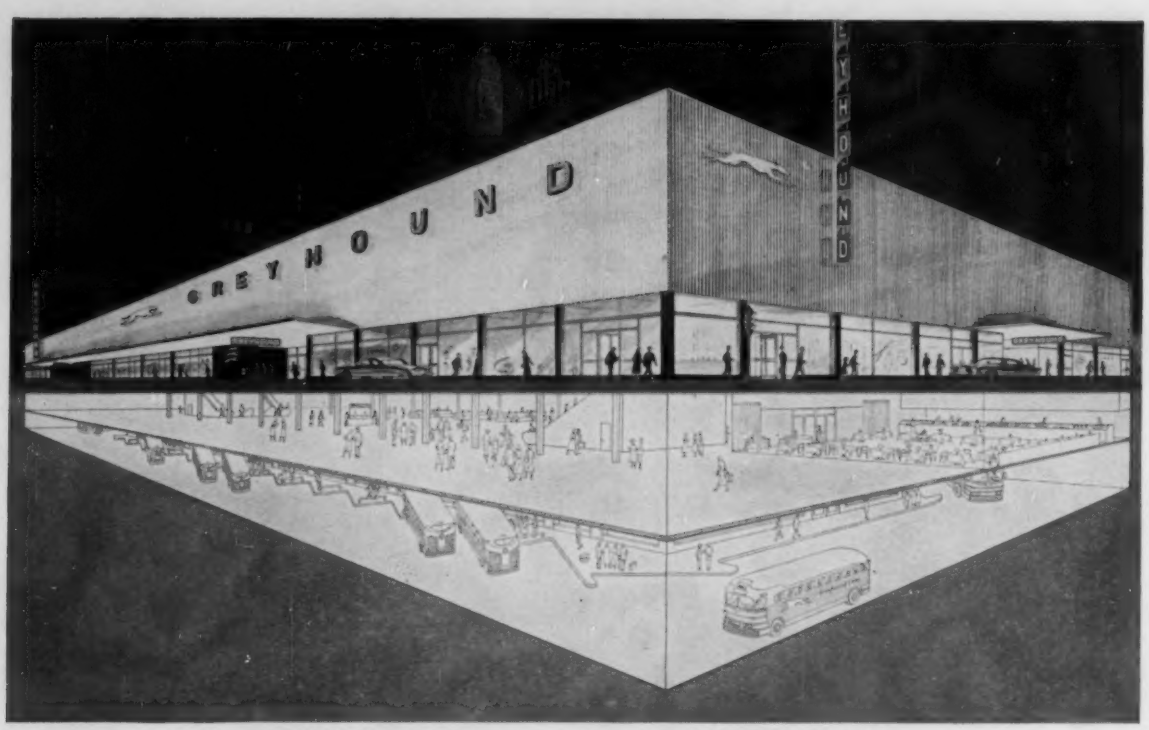


GREYHOUND'S NEW CHICAGO TERMINAL • OWNER: CHICAGO GREYHOUND TERMINAL, INC.

ARCHITECTS-ENGINEERS: *Skidmore, Owings & Merrill, Chicago*
GENERAL CONTRACTORS: *John W. Harris Associates, Chicago*
HEATING CONTRACTOR: *Gallaher & Speck, Inc., Chicago*
VENTILATING CONTRACTOR: *Mehring & Hanson Co., Chicago*

New Greyhound terminal has basement in the "attic"

AMERICAN BLOWER equipment helps provide country-fresh conditioned air for Greyhound's unique new Chicago depot

How do you build a bus terminal in downtown Chicago and avoid "Loop" traffic jams? Greyhound used a unique design, with bus tunnels 25 feet below street level. The resulting ventilation problem was solved with American Blower equipment.

For the bus-concourse level, with its open-ended tunnels, had to be cleared of exhaust fumes – to keep them from filtering up into the air-conditioned waiting room, restaurants and shops.

To overcome this obstacle, and save valuable space, air-handling equipment was installed in the top levels – putting equipment, usually in the basement, up in the "attic." American Blower Fans exhaust fumes and stale air from all levels, and circulate clean, conditioned air – slightly pressurizing the building, and creating an ideal indoor climate.

Perhaps American Blower can help *you*. Each of our representatives is a qualified engineer, with a complete knowledge of air handling and air conditioning equipment–and is prepared to give "on the spot" information.

Modern waiting room is two floors high. Greyhound terminal is geared to handle 120 buses an hour; 18,000 passengers daily.

American Blower equipment in this building includes: 22 HS Fans, 9 Air Conditioning Units, Utility Sets and Ventura Fans.

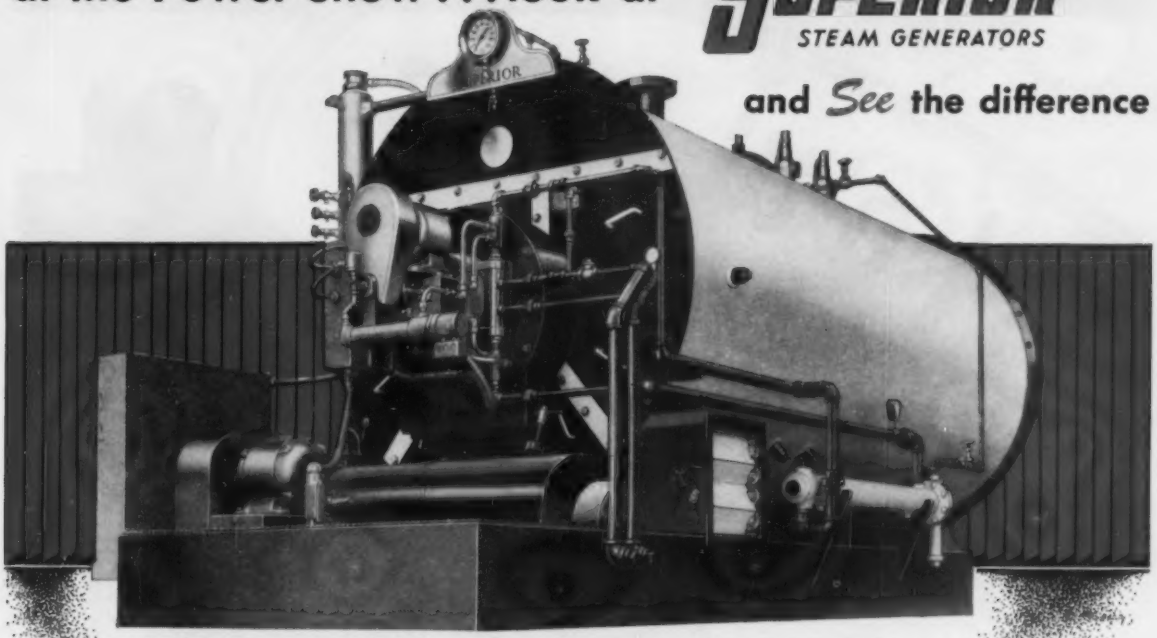
AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO
Division of American Radiator & Standard Sanitary Corporation

AMERICAN BLOWER

AIR CONDITIONING EQUIPMENT FOR ALL TYPES OF INDUSTRIAL PLANTS, COMMERCIAL AND PUBLIC BUILDINGS

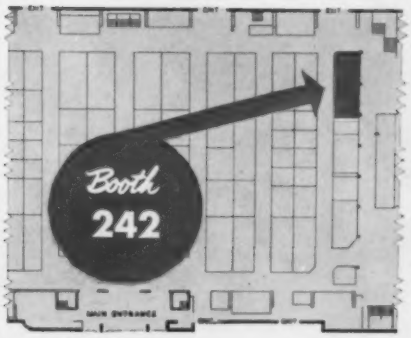
at the Power Show . . . look at SUPERIOR STEAM GENERATORS

and *See* the difference



HERE'S WHAT TO LOOK FOR:

POWER SHOW
NOV. 14th through NOV. 18th
1955



WABASH AVENUE

CHICAGO COLISEUM
CHICAGO, ILL.

Look . . . at Superior's 4-pass fire-tube design . . . ample heating surfaces with a minimum of 5 sq. ft. per b.h.p.

Look . . . at Superior's built-in multiple induced-draft fans . . . drawing evenly across the entire tube area, and eliminating the need for an expensive chimney.

Look . . . at Superior's Rotary Burner with its own fan supplying primary air . . . fully automatic with oil or gas, or both . . . change from either fuel to the other quickly, without dismantling equipment or interrupting steam supply.

Look . . . at Superior's safety features . . . induced draft which prevents the escape of combustion gases into the boiler room . . . fool-proof combustion gas pressure-relief port . . . constant gas pilot throughout gas firing periods . . . dual purging of all gas passages, both before and after firing.

Look . . . at the overall picture . . . a complete packaged steam plant. One purchase shipped completely assembled after factory test to assure dependable operation at a guaranteed thermal efficiency of more than 80%.

Look . . . at Superior's catalog for the complete story. If you're not going to the show, write for Catalog 704.

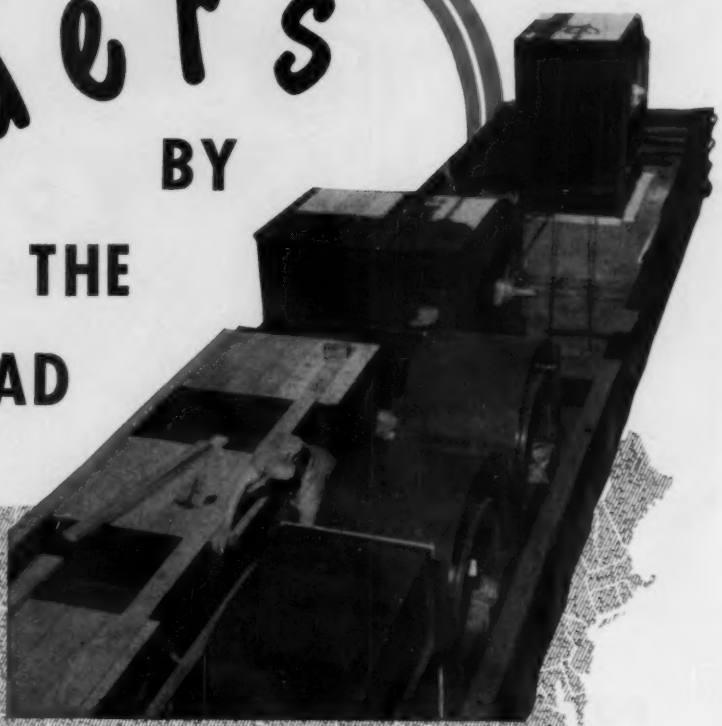
for performance you can **BANK** *on*

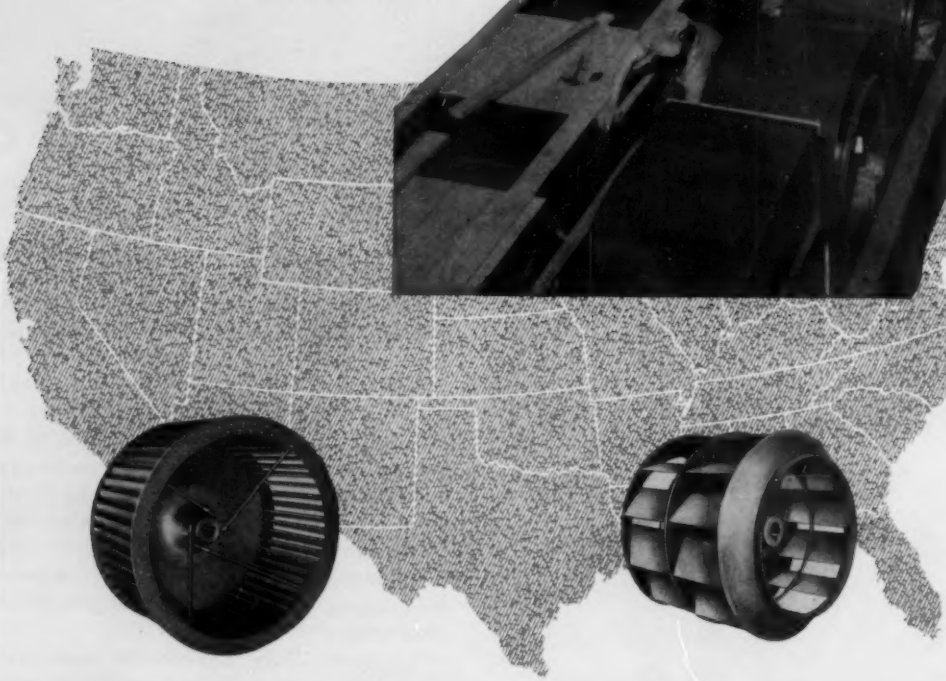
SUPERIOR STEAM GENERATORS

SUPERIOR COMBUSTION INDUSTRIES INC.
TIMES TOWER, TIMES SQUARE, NEW YORK 36, N.Y.

The MASSACHUSETTS Line®

Blowers BY THE CARLOAD





SQUIRREL CAGE TYPE
(Forward Curve Blade)
• Slow Speed
• Extremely Quiet in Operation.
Bulletin No. 101

POWER FIXED TYPE
(Backward Curve Blade)
• Quiet Operation at medium speed.
Bulletin No 105

MASSACHUSETTS BLOWER DIVISION

The BISHOP & BABCOCK Mfg. Co.

4901 HAMILTON AVENUE • CLEVELAND 14, OHIO

Matchless Beauty and Performance In Heating and Cooling

Lima

MATCHED

PERIMETER BASEBOARD LINE

HERE — at competitive price — is the finest, most beautiful line of *matched* baseboard units you can install for heating and cooling in new houses and modernization jobs.

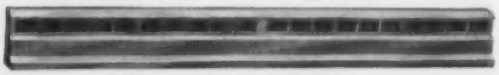
All Lima baseboard diffusers and return air grilles have horizontal louvers which harmonize perfectly with the horizontal lines of baseboard, window and floor. All units have the same permanent medium beige finish which saves repainting cost unless requested by the customer. And all Lima baseboards have exclusive features that reduce installation time and labor.

The performance is just as outstanding. The Lima Baseboard Diffuser assures efficient air diffusion spread evenly over a wide area regardless of velocity or damper setting. Reasonably high velocity and correct vertical angle induces recirculation of air within room for gentle, imperceptible air motion.

It costs no more to give your customers the matching beauty, extra sturdy construction and matchless performance of Lima Matched Baseboard Diffusers and Return Air Grilles. Ask your wholesaler or write direct for literature and prices.

Series 70

DIFFUSER with rattle-free built-in automatic pushbutton damper.



Series 75

DIFFUSER without damper, for economy installations.

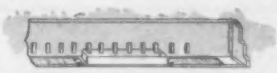
Series 77

NEW RETURN AIR GRILLE with maximum free area, for matching beauty and performance.

FASTER INSTALLATIONS

IN NEW AND OLD HOUSES

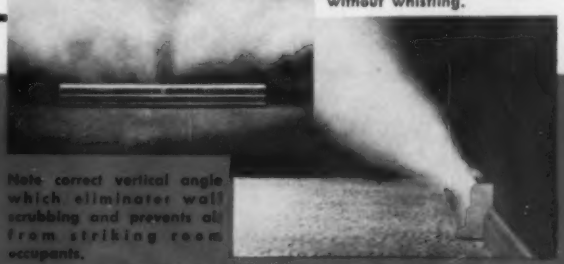
Boot can be quickly located any place along bottom of diffuser or grille without expensive cutting. Base has pre-cut boot openings separated by easily removable ⅜" mullions and boot fastening clips stamped in back section to hold boot in place.



Steel strip furnished with diffuser unit to seal openings not used. The entire operation is done in a jiffy.

See You Nov. 30th In New York At The 42nd Annual Convention National Warm Air Heating and Air Conditioning Association

Smoke test photos show full fan-shaped blanket of air spread over wide area. Air pattern holds constant even at low cfm delivery, and velocity remains uniform without whistling.



Note correct vertical angle which eliminates wall scrubbing and prevents air from striking room occupants.

Lima REGISTER CO.
LIMA, OHIO

INDOOR COMFORT

Lima Quality Diffusers, Registers and Grilles Are Sold Exclusively Through Heating Wholesalers and Manufacturers.

A CHALLENGE!

THE STRONGEST MADE BY ANY GALVANIZED SHEET:

can be made of
WHEELING
SOFTITE®
galvanized sheets

- Take all the ideal working qualities you have ever hoped for in a galvanized sheet . . . put them all together and you'll get some idea of the amazing workability of Wheeling SOFTITE Galvanized Sheets.

Here is a soft, ductile sheet, with the tightest zinc coating yet produced . . . so tight, in fact, that you can use Wheeling SOFTITE to make anything you make of steel sheets.

If *you've* been having difficulty using customary galvanized sheets, try Wheeling SOFTITE. So many users have acclaimed it the ideal galvanized sheet that Wheeling is tripling its SOFTITE production facilities in 1955.

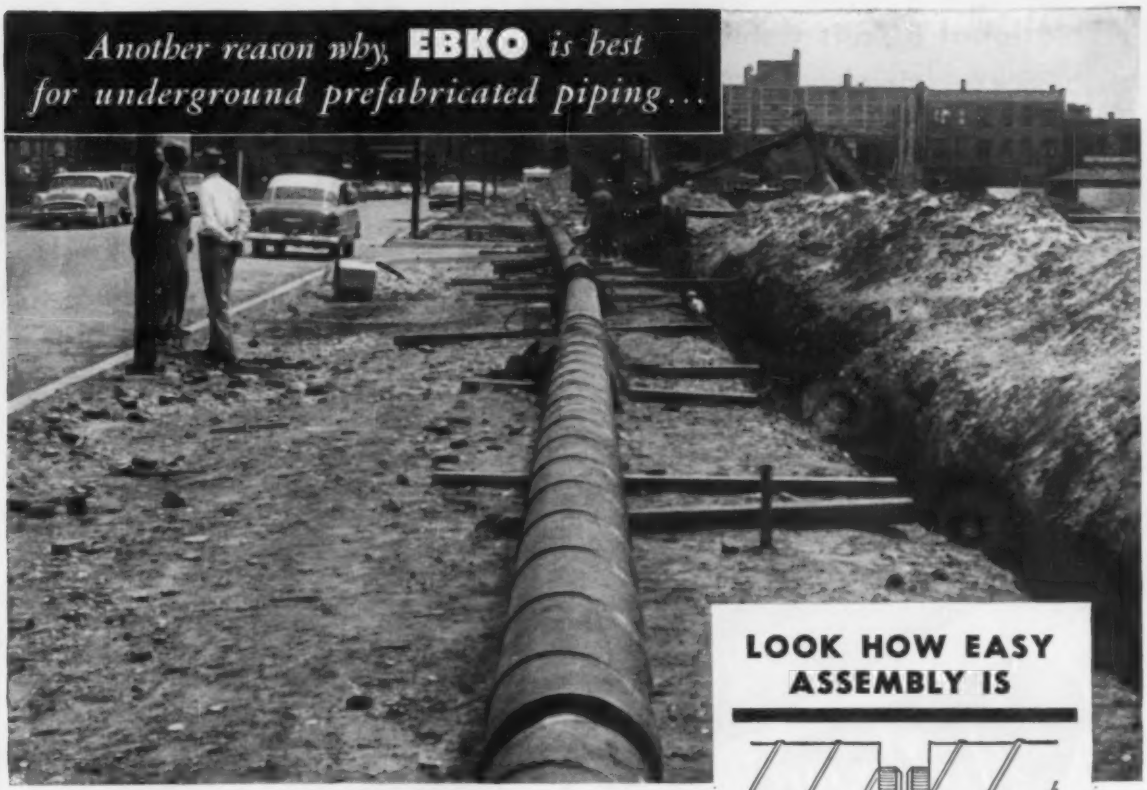
Get details today. Call or write the Wheeling sales office nearest you. Wheeling Steel Corporation, Wheeling, West Virginia.

IT'S WHEELING STEEL

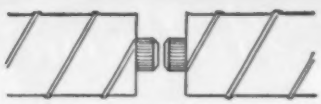
DISTRICT SALES OFFICES

ATLANTA BOSTON BUFFALO CHICAGO CINCINNATI CLEVELAND DETROIT
HOUSTON NEW YORK PHILADELPHIA ST. LOUIS SAN FRANCISCO WHEELING

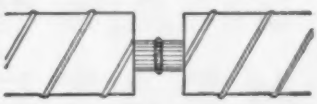
Another reason why, **EBKO** *is best for underground prefabricated piping...*



LOOK HOW EASY ASSEMBLY IS



1. Place pipe on lubricated blocks beside the trench.



2. Align inner pipes, pull together, weld and then test for leaks.

3. Apply split insulation and band in place.

4. Pull casing together, weld and test.

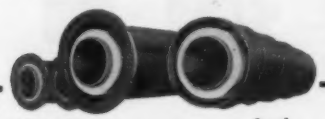
EBKO systems are the easiest to install

A complete EBKO prefabricated insulated underground piping system can be installed in less time and with less work than other prefabricated systems. Here's why:

A plan layout accompanies every system with all pipe, fittings and accessories plainly marked. All parts are shipped in the order of their installation. Beside-the-trench-assembly and 14 gauge *minimum* steel casing strength eliminates necessity for wide or deep trenches. Note on right, simple assembly requires only welding and application of insulation and the welders work upright for the majority of welds.

. . . and remember, *only* EBKO provides steel casing with the Ebko-lok® seam that imparts further crush resistant strength to the casing for positive impact protection.

See your local EBKO Representative—let him show you *all* the reasons for EBKO's superiority or write for details — no obligation.



Cast Iron Steel

EBKO

Underground and Overhead Prefabricated Piping Systems

© 1955, E. B. Kaiser Co.

E. B. KAISER CO.

Since 1890

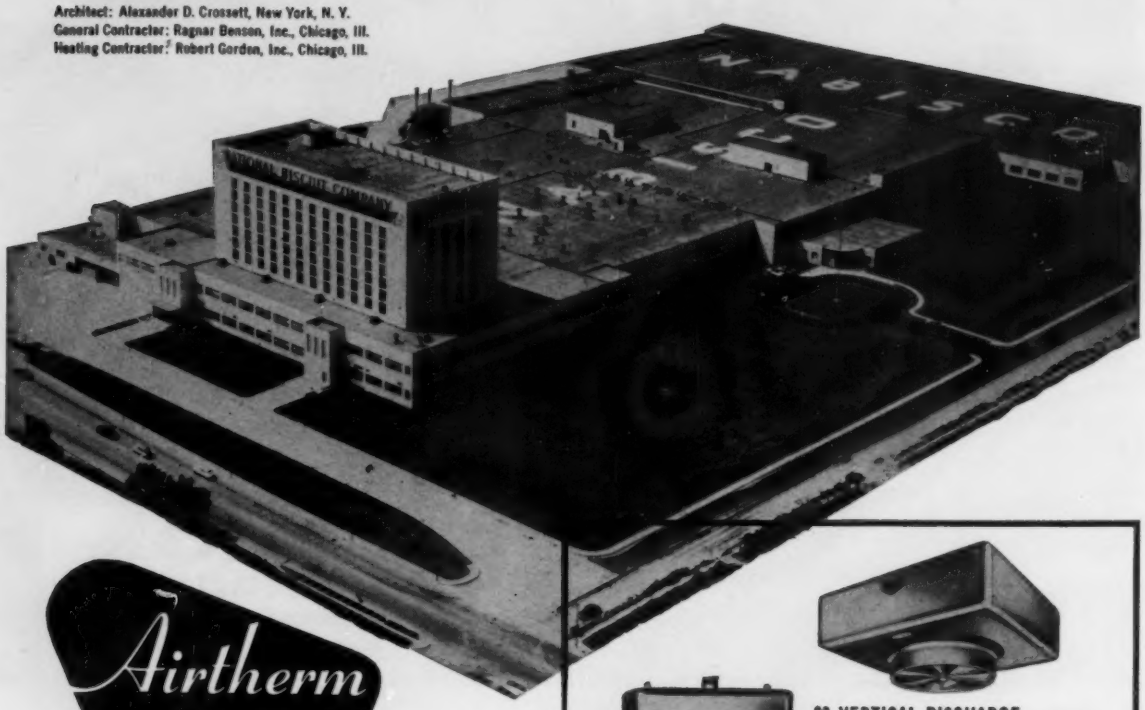
2118 West Lake Avenue • Glenview, Illinois

Phone: Glenview 4-4500

For STEAM • CONDENSATE • HIGH TEMPERATURE and CHILLED WATER • REFRIGERANTS • GASES • ETC.

National Biscuit Company
Chicago, Illinois

Architect: Alexander D. Crossett, New York, N. Y.
General Contractor: Ragnar Benson, Inc., Chicago, Ill.
Heating Contractor: Robert Gordon, Inc., Chicago, Ill.



Airtherm

90 VERTICAL DISCHARGE HEATERS INSTALLED from 102,500 BTU to 185,000 BTU

92 HORIZONTAL DISCHARGE HEATERS INSTALLED from 14,800 BTU to 250,000 BTU

STEAM UNIT HEATERS

WARM THE WORLD'S LARGEST BAKERY

To achieve flexible, economical heating throughout Nabisco's new $20 million Chicago plant, 182 Airtherm steam unit heaters have been installed. The plant is the world's largest cracker and biscuit bakery with ovens the length of football fields, almost 20 acres of floor space and a capacity of 167 million pounds yearly.

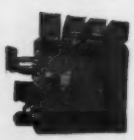
When the area to be heated presents unusual problems, chances are you can solve them easily and economically with the flexibility of Airtherm unit heaters.

Convectors

Vertical Steam Unit Heaters

Horizontal Steam Unit Heaters

Centrifugal Fan Type Unit Heaters


Direct Fired Space Heaters

Gas Fired Unit Heaters

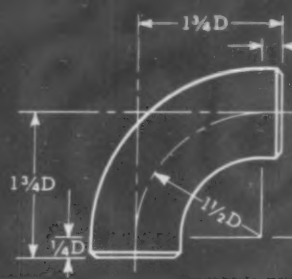
FOR HEATING SATISFACTION . . . THINK FIRST OF

Airtherm MANUFACTURING COMPANY

700 South Spring Avenue • St. Louis 10, Missouri

The Unequalled Variety of MIDWEST ELBOWS will Save Money and Simplify Design of Your Welded Piping

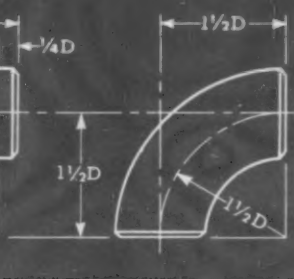
1 LONG RADIUS LONG TANGENT



SIZES: 2" thru 36"

A premium fitting at the same price as regular long radius elbows, but with LONG TANGENTS on both ends . . . an exclusive Midwest feature that saves time and pipe.

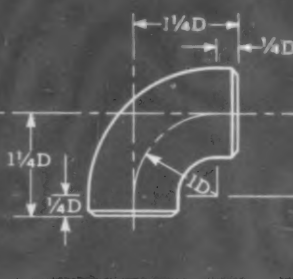
2 LONG RADIUS ASA TYPE



SIZES: ¾" thru 36"

Dimensions conform to the American Standard for Steel Butt-Welding Fittings, ASA B16.9, and the Manufacturers Standardization Society Specification DS-11.

3 SHORT RADIUS LONG TANGENT



SIZES: 14" thru 36"

Developed for those installations that require an elbow with a short radius, yet this elbow provides all the additional advantages of Midwest "Long Tangents".

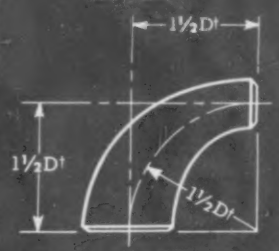
4 SHORT RADIUS

D-Nominal Pipe Size

SIZES: 1" thru 36"

Where space limitations prevent the use of Midwest "Long Tangent" or ASA long radius elbows, these short turn elbows without tangents are recommended.

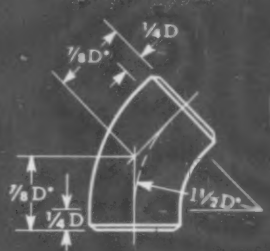
5 LONG RADIUS REDUCING



SIZES: 2" thru 16"

This elbow takes the place of two fittings . . . a straight elbow and a reducer, thus saving space and one weld. Only Midwest makes the reducing elbow in this size range.

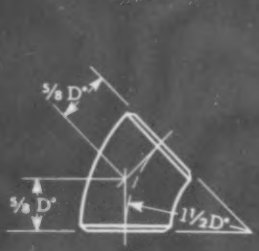
6 LONG RADIUS LONG TANGENT



SIZES: 2" thru 30"

The Midwest "Long Tangent" type is also available in 45° elbows at no increase in price. These tangents simplify the assembly of fitting to pipe or flange.

7 LONG RADIUS ASA TYPE



SIZES: ¾" thru 36"

Like all Midwest Elbows, these 45° elbows are selectively reinforced to compensate for the higher stresses that occur in the throat of all elbows subjected to internal pressure.

8 CONTUR-ELLS

†-Larger Nominal Pipe Size

*-Approximate Value

SIZES: 22" thru 30"

Primarily designed for the gas transmission industry, these are available in small angles, with 8" tangents on both ends, and in carbon steel or high-yield steels.

Exceptional latitude in piping design and economy in erection . . . that's why the unequalled variety of Midwest Elbows is becoming increasingly popular. For example, the Midwest "Long Tangent" Elbow saves pipe . . . permits faster, easier, more accurate lining up . . . often eliminates a short nipple and its extra weld . . . costs no more than other elbows. For all the advantages to be gained by specifying Midwest Elbows, see Catalog 54; ask our distributor for a copy or we shall be glad to send it to you.

6734

MIDWEST PIPING COMPANY, INC.

Main Office: 1450 South Second Street, St. Louis 4, Mo.

Plants: St. Louis, Passaic and Los Angeles

Sales Offices:
New York 7—50 Church St. • Chicago 3—79 West Monroe St. • Cleveland 14—616 St. Clair Ave. • Los Angeles 33—520 Anderson St. • Houston 2—1213 Capitol Ave. Tulsa 3—224 Wright Bldg. • Miami 34—2103 Le Jeune Rd. • Boston 27—426 First St.

STOCKING DISTRIBUTORS IN PRINCIPAL CITIES

MIDWEST WELDING FITTINGS Improve Piping Design and Reduce Costs

POWER PACKED MOTORS

By

LIMA IN NEW NEMA FRAME SIZES

A New Approach to Perfection

● MORE POWER ● BETTER PROTECTION

● SMALLER SIZE ● LIGHTER WEIGHT

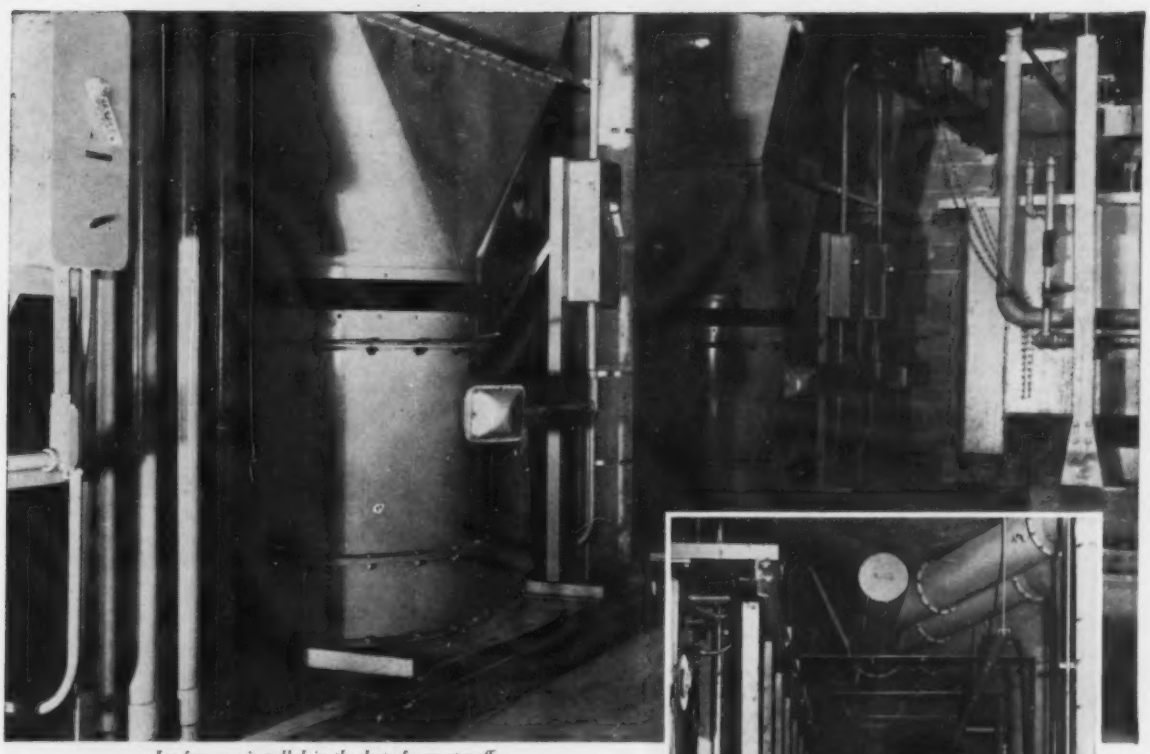
For complete information . . . See your local Lima Representative listed in Thomas' Register, MacRae's Blue Book, Conover-Mast Purchasing Directory, or write—

Of course, the former NEMA frame sizes 66 to 505 (1/3 to 150 H.P.), incorporating the latest advances in motor design, will remain in production.

THE LIMA ELECTRIC MOTOR COMPANY 4989 Findlay Road Lima, Ohio

Representation throughout the U.S., Canada and abroad

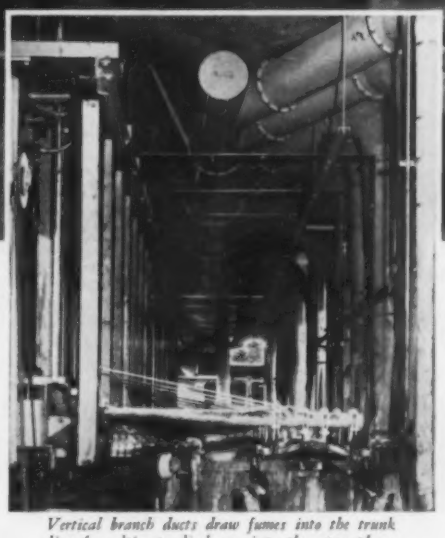
FIRST . . . FOR MOTORS . . . DRIVES . . . GRINDERS



Joy fans are installed in the ducts for greater efficiency, easier installation, and economy of floor space.

PLATING LINE VENTED BY JOY AXIVANE® FANS

Corrosive Air Removed in Jig-time By "In-the-Duct" Installation of Exhaust Fans



Vertical branch ducts draw fumes into the trunk line for ultimate discharge into the atmosphere.

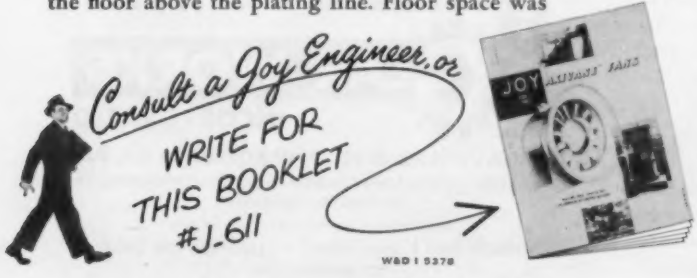
An interesting, and necessary, feature of the new zinc and cadmium plating line at Appleton Electric Company, Chicago, is the compactness of the Joy Axivane Fan exhaust system.

This exhaust system carries off the hot, corrosive air from the plating line up to the roof where it is discharged into the atmosphere.

Centrifugal units would have necessitated an expensive modification in the building structure, in addition to a larger, more complicated duct system.

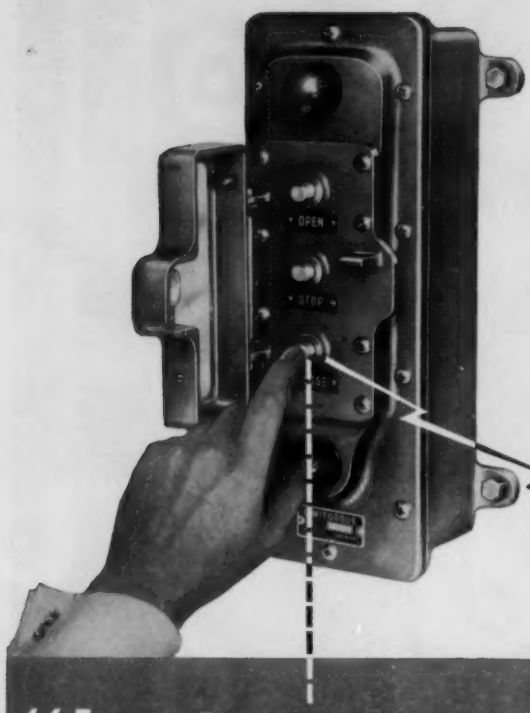
The compact, in-line design of the Joy Axivane Fans permitted installation *right in the ducts* on the floor above the plating line. Floor space was saved, installation costs were drastically reduced, building structure did not have to be altered, and a much smaller and simpler duct system was constructed!

Joy Axivane Fans will show you new standards in efficiency, compactness, quietness, and outstanding versatility. There are 136 models . . . all with adjustable blades . . . for volumes up to 300,000 CFM and pressures to 11″ wg. Get the full story on Joy Fans by writing for Bulletin J-611, TODAY. ***Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.*** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*



JOY

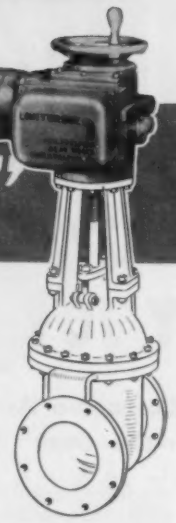
SPECIALISTS IN THE COMPRESSION AND MOVEMENT OF AIR AND GASES SINCE 1885



truly *Automatic* VALVE OPERATION

with Limitorque®

"just press the button"



The above is a Type SMA-000 LimiTorque for operating smaller valves. There's a type and size of LimiTorque for every valve operating need.

Think of the time, labor and money that can be saved by opening and closing valves in remote, inaccessible or distant locations with LimiTorque . . . automatically, from a centrally located control panel. LimiTorque not only operates valves at the speed required, but it "limits the torque" applied to the valve operating parts and thus prevents damage to stems, seats, discs or gates . . . and too, the handwheel "cannot rotate" when the valve is being motor-operated. LimiTorque may be actuated by any available power source; such as electricity, gas, steam, water, oil or air—and is readily adapted for Microwave Control. Thousands of these units are being used in Power Plants, Oil Refineries and Pipe Lines, Water and Sewage Plants, Chemical Plants, Pulp and Paper Mills, and on Shipboard.

Send for Catalog L-54, and be convinced.

PHILADELPHIA GEAR WORKS
INCORPORATED

ERIE AVE. AND G ST., PHILADELPHIA 34, PA.
NEW YORK • PITTSBURGH • CHICAGO • HOUSTON • LYNCHBURG, VA.
BALTIMORE • CLEVELAND
LimiTorque Corporation—Philadelphia
Industrial Gears & Speed Reducers • LimiTorque Valve Controls
ESTABLISHED 1892

Owner: Davidson County Board of Education
Architects: Southgate & Preston, Nashville, Tenn.
General Contractor: W. F. Holt & Sons, Inc., Nashville, Tenn.
Piping Contractor: John Bouchard & Sons Co., Nashville, Tenn.
Spang Distributor: John Bouchard & Sons Co., Nashville, Tenn.

24 tons

OF SPANG® CW STEEL PIPE

The rapidly expanding population of school children in Madison, Tennessee, a suburb of Nashville, created the need for a new high school, and the result is this modern 36-room building, now in full operation. Facilities include well-planned classrooms, library, kitchen, dining room, cafeteria, gymnasium, locker rooms and stage.

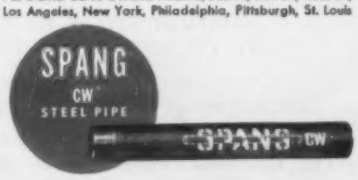
For plumbing, heating and gas lines throughout Madison High, the specifications called for *top-quality* SPANG CW Steel Pipe, because SPANG will give long years of dependable service.

SPANG CW is *quality-controlled* throughout its manufacture; during forming and welding, close control is maintained; before shipment, it is thoroughly tested and inspected. This SPANG *quality-control* produces pipe which is easy to cut, thread, bend and weld, resulting in savings to you through faster and lower cost *top-quality* installations.

Join the engineers, architects and contractors whose first choice is SPANG CW for all types of installations. Next time you order pipe, specify *top-quality* SPANG CW Steel Pipe. Your local SPANG Distributor will give you *top-quality* service, too!

SPANG-CHALFANT
DIVISION OF THE NATIONAL SUPPLY COMPANY

General Sales Office: Two Gateway Center, Pittsburgh, Pa. District Sales Offices: Atlanta, Boston, Detroit, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, St. Louis



You get

SERVICE WITH A SMILE...

when you specify AIRTEMP for business and industrial air conditioning

So many people are eager to help you when you specify Airtemp!

First there are the *top engineers* of Airtemp Construction Corporation . . . ready to give you the benefit of years of *specialized* experience in air conditioning.

Then there are your *local* Airtemp service men—factory-trained and equipped to guarantee on-the-spot service through the years ahead.

All the people you deal with are fully trained by Airtemp and *Chrysler*—names long famous for advanced engineering and quality manufacture.

The result of Airtemp's fine engineering and efficient design is extremely low operating cost. So, when you consider that there's an Airtemp system to meet *every* qualification—there's hardly any reason for *not* specifying Airtemp!

AIRTEMP SERVES THE NATION!

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HAROLD GRUBMAN CO., North Hollywood Calif. Engineer: Sam L. Kaye, Los Angeles; Builders: Craig and Randall, Los Angeles.

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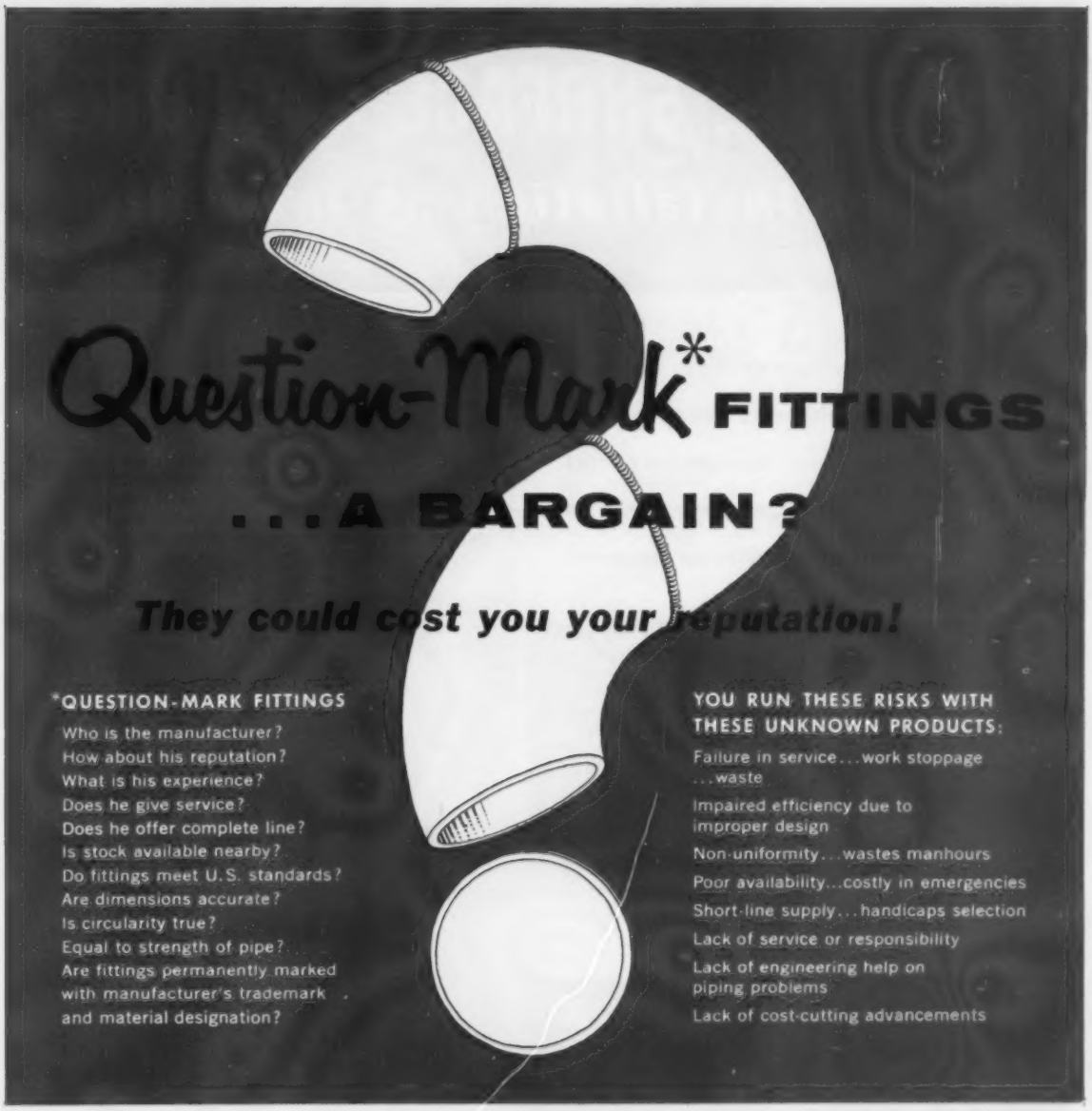
DIVISION
CHRYSLER CORP

AIR CONDITIONING · HEATING FOR HOMES, BUSINESS, INDUSTRY



Question-Mark* FITTINGS

...A BARGAIN?

They could cost you your reputation!

***QUESTION-MARK FITTINGS**

Who is the manufacturer?
How about his reputation?
What is his experience?
Does he give service?
Does he offer complete line?
Is stock available nearby?
Do fittings meet U.S. standards?
Are dimensions accurate?
Is circularity true?
Equal to strength of pipe?
Are fittings permanently marked with manufacturer's trademark and material designation?

YOU RUN THESE RISKS WITH THESE UNKNOWN PRODUCTS:

Failure in service...work stoppage ...waste

Impaired efficiency due to improper design

Non-uniformity...wastes manhours

Poor availability...costly in emergencies

Short-line supply...handicaps selection

Lack of service or responsibility

Lack of engineering help on piping problems

Lack of cost-cutting advancements

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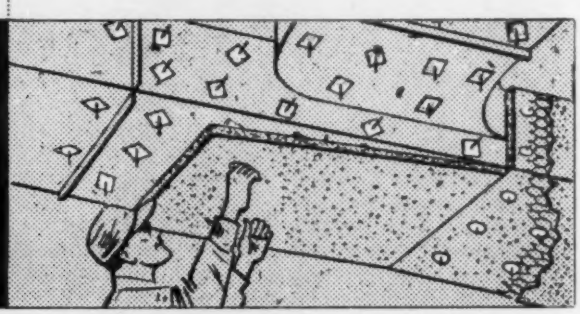
Speed Installation of Insulation

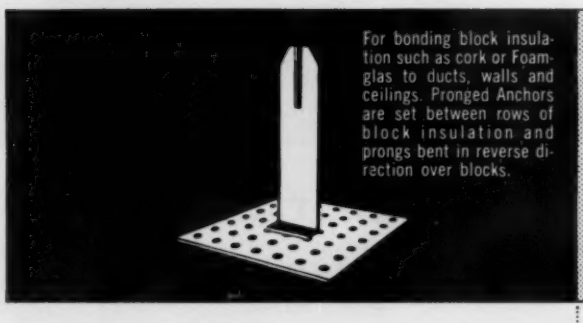
Eliminate drilling, welding, expansion bolts! Reduce time, construction, and installation costs! No damage to surfaces in event of installation removal!

Use Miracle Surface Anchors to provide firm support for block, board or blanket types of insulation on clean rigid surfaces. (Use for conduits, pipes, and fixtures, too.) Also to provide anchorage in otherwise inaccessible locations.

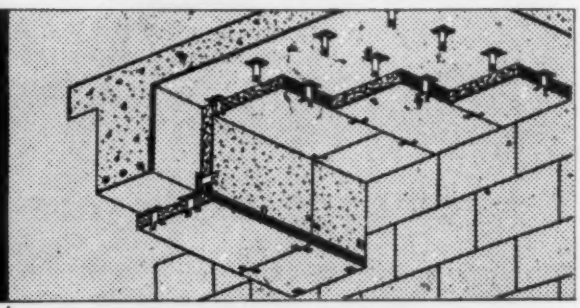
Miracle Surface Anchors consist of perforated metal plates, 2" x 2" or 2¾" x 2¾" to the center of which is welded a spindle, prong, nail, bolt, or threaded stud, zinc plated, with dichromate finish after manufacture. Perforated base provides anchorage by bonding with Miracle Anchor Adhesive to masonry, metal, plaster, etc.

For bonding fiber glass, batts, mineral wool, etc., to ducts, walls and ceilings. Lock washer is designed to hold insulation firmly in place thus eliminating delamination of insulation.





For bonding block insulation such as cork or Foamglas to ducts, walls and ceilings. Pronged Anchors are set between rows of block insulation and prongs bent in reverse direction over blocks.



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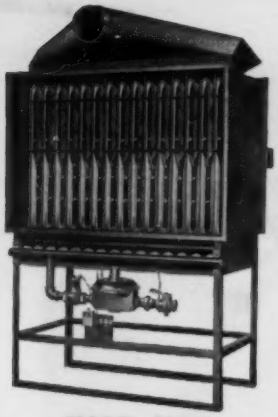
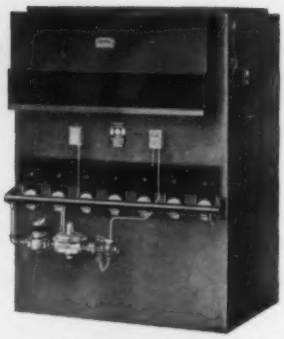


MODEL SED-E

MODEL SED-E — Non-corrosive type 321 stainless steel heat exchanger. Permits installation downstream of cooling equipment, for continuous blower operation. Air throughput in either direction. 80,000 to 600,000 Btu input.

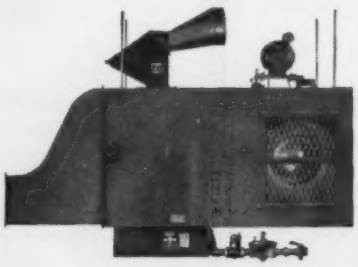
MODEL SED-S — Same as SED-E except controls are at the side, instead of at the end where accessibility requires either SED-E or SED-S is available in sizes from 80,000 to 600,000 Btu input in increments of 40,000 Btu.

MODEL SED-S



MODEL SED-VF

MODEL SED-VF — Tested and approved as a duct furnace; type 321 stainless steel. Re-circulated or fresh air enters through bottom, sides, or back. Built-in air bypass, vent in front. Sizes from 70,000 to 245,000 Btu input.



MODEL SEU

MODEL SEU — Suspended unit heater. Recirculates room air. Diffuser outlet with adjustable vertical and horizontal vanes. Double inlet forward curve blower. Continuous duty, variable pitch drives, raised port burners. 80,000 to 600,000 Btu input.

MODEL SEC

MODEL SEC — Forced air furnace. Stainless steel heat exchanger sections seam and arc welded. One piece cast iron burners with drilled ports. Oversize double inlet blower, glass or washable filters. 6 sizes — 70,000 to 245,000 Btu input. For zero clearance.

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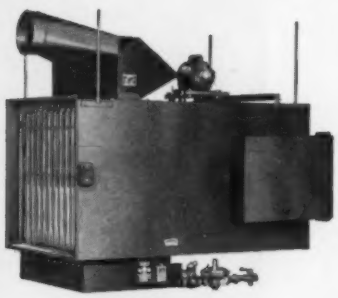

MODEL SES

MODEL SES—Forced air, suspended furnace for installation in suspended duct system. Inlet and outlet designed for sheet metal duct connection. Double inlet forward curved blower. Continuous duty variable pitch drives, raised port burners.

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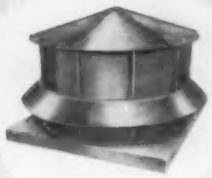
Problem: Quietness and Efficiency in Apartment Houses

Solution: GALLAHER Power Roof Exhausters



These four fashionable New York apartment buildings all have Gallaher power roof exhausters. Left to right: Glen Briar Apartments, "Highpoint-on-the-Hudson", La Sala Apartments and Riviera La Sala Apartments.

IN the fashionable Riverdale section of New York City, these apartment houses must be particularly well-equipped with adequate ventilation. Not only must they have equipment that meets the needs of the people living there, but they also must qualify for New York City's certificate of occupancy.

Quietness and efficiency (i.e. low noise levels and high, accurate capacity) are essential.

Gallaher power roof exhausters were specified for all of these apartments. Gallaher assures efficiency because Gallaher specifications are accurate—accurate because every detail of the unit is the result of research-design.

This same streamlined design assures the quietness of the Gallaher unit by drastically reducing turbulence.

More and more engineers and architects are realizing the value of Gallaher efficiency. The low installed silhouette, the patented scroll design and air seal-off, low noise levels, availability in special metals, weatherproof design—these are features that have made Gallaher a recognized leader and pioneer in the field of industrial and public ventilation.

Direct Drive units: 150-11,000 CFM. Belt Drive: 3500-65,000 CFM, developing static pressures to 4".

Patents 2188741 2526290
Patents pending

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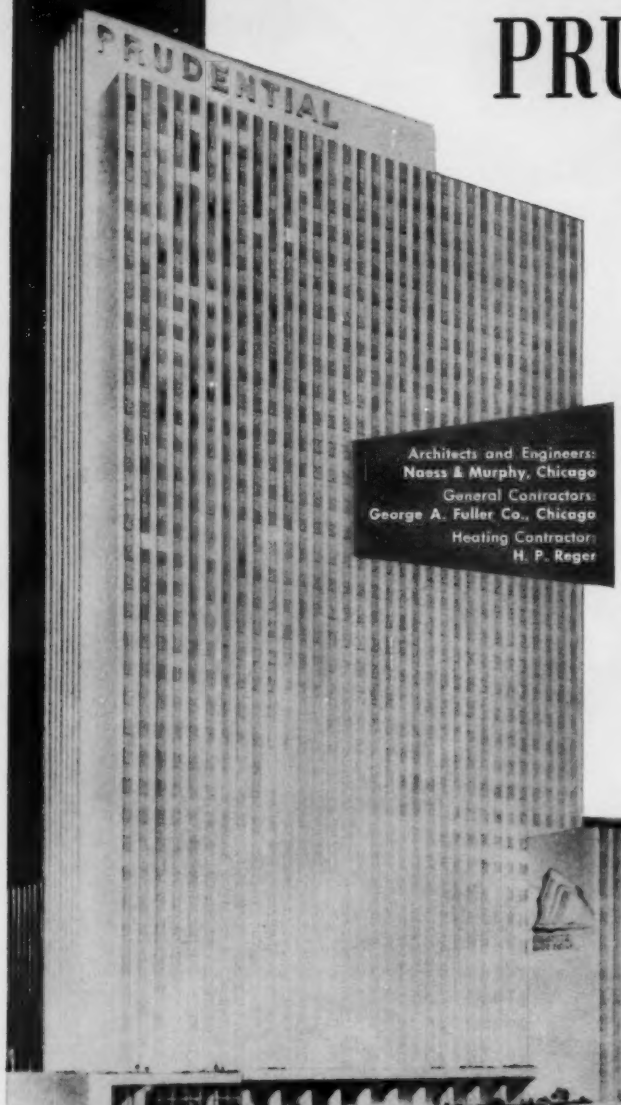
Fabulous 40 Million dollar Mid-America home of...

PRUDENTIAL

Equipped with Marsh Valves, Traps, Gauges



Architects and Engineers:
Naess & Murphy, Chicago
General Contractors:
George A. Fuller Co., Chicago
Heating Contractor:
H. P. Reger

Skyscraper among skyscrapers, the 40-million dollar Prudential Building stands 44 feet above Chicago's highest rooftop—a giant 400-foot-square edifice containing a million sq. ft. of office space, 30% of it is to be the new "Mid-America Home Office" of Prudential.

It is easy to see why Prudential is building this "Mid-America Home" for Illinois and Indiana when you hear that in the last year Prudential wrote more than 468 millions in policies and paid out 88 millions to beneficiaries in these two states alone. In Illinois and Indiana Prudential now has 4½ *billions* of insurance in force!

The great building is a city in itself . . . with a spectacular restaurant and observation floor at the top, year round air conditioning with personal control in individual offices, and ultra-modern features far too numerous to cover in limited space.

As in so many masterpieces of architecture and construction, Jas. P. Marsh Valves, Traps and Gauges are used exclusively wherever equipment of the Marsh type applies. On that next job see for yourself the dependable performance that has made Marsh heating specialties first choice in finest buildings.

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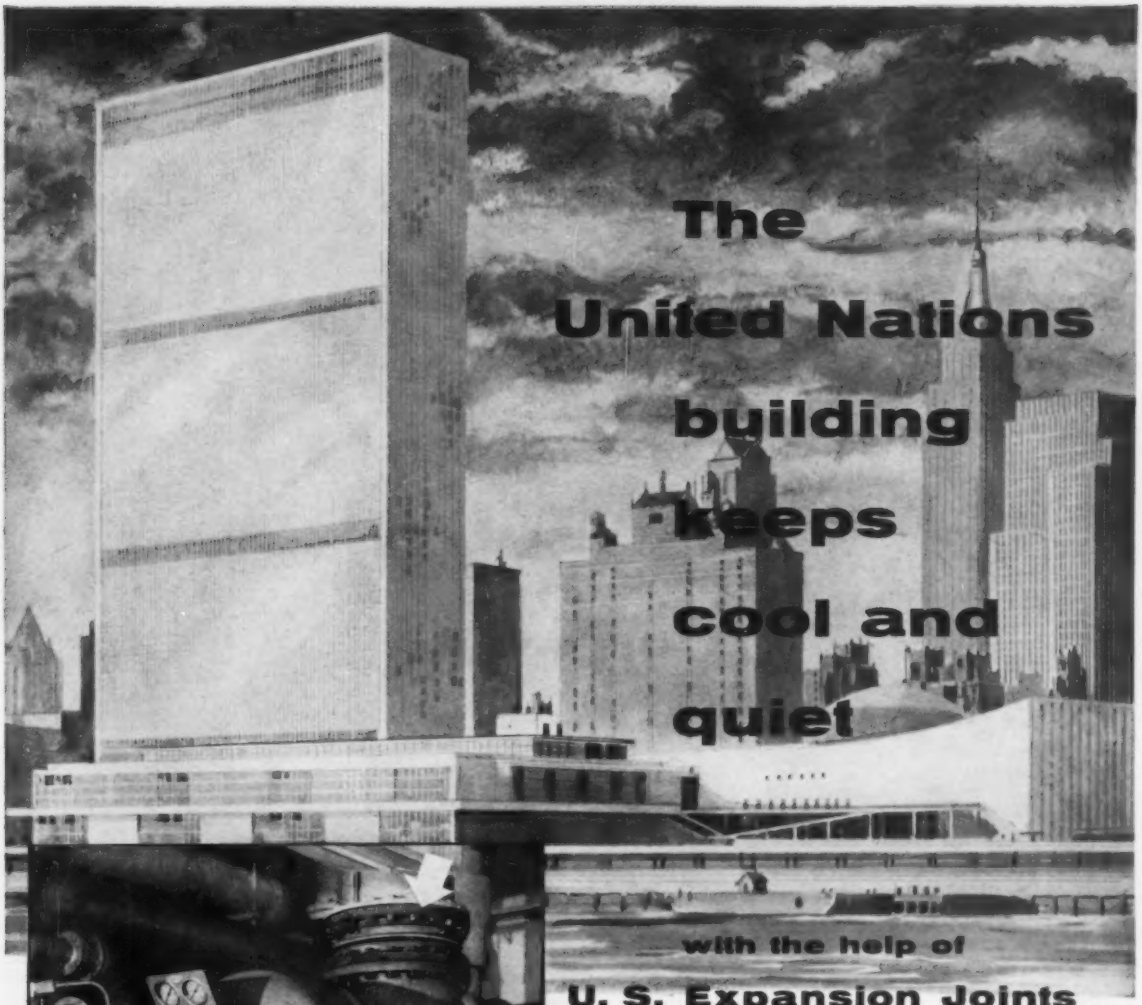

U. N. personnel remain cool and relaxed in their great edifice. The air-conditioning system is noiseless and vibration-free. Flexible rubber connections known as U. S. Expansion Joints "take up" any movement in the piping, effectively *hushing* and "calming down" vibration and pump noises in the system. In the photo, for example, you see one of the refrigerating compressors in the U. N. building. Note the U. S. Expansion Joints, one going out from the top of the turbine, the other from the side. U. S. Expansion Joints are also used for the chilled-water lines from the water chillers and the refrigerating lines from the refrigerating compressors; also on the water lines to and from the cooling towers.

A product of United States Rubber Company, these joints also offset stresses caused by expansion and contraction. Since they have no moving parts to wear or bind, U. S. Expansion Joints last a long time. Some are still in service after 30 years—a record unmatched by any other joint!

For air-conditioning systems, or in any pipe line where noise and vibration are problems, investigate U. S. Expansion Joints. Call any of the 27 "U. S." District Sales Offices or write address below.

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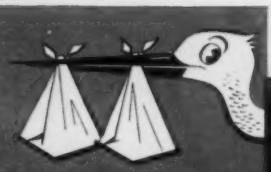
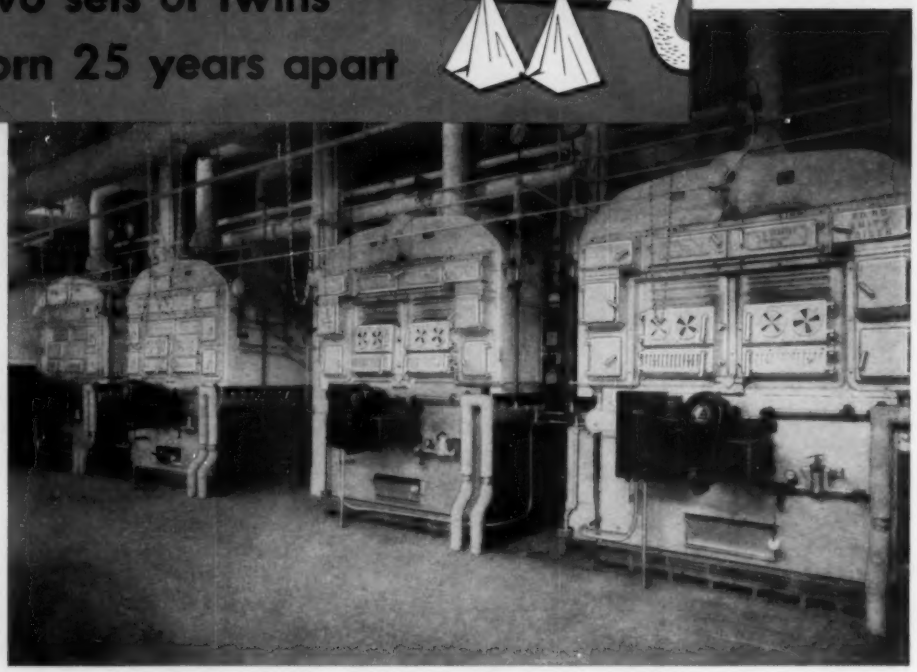
These two sets of twins were born 25 years apart





Architects:
Kilham, Hopkins, Greeley & Brodie

•

Heating Engineers:
R. D. Kimball Company

•

Heating Contractor:
P. J. Riley and Company

Which twins are the older?

Needham, Massachusetts, *looked ahead* 25 years ago — *and looks ahead today.* It is one of the fastest-growing communities in the State. And — like so many other towns — it has had to face the future *now.*

25 years ago, its new high school building appeared adequate for many years to come. And, *looking ahead at that time,* to long-term economy of fuel and low maintenance costs, the town invested a few extra dollars in the best boilers available — two 20-section 60 Smith Cast Iron Boilers for coal-burning.

In 1954, the town decided to double the capacity of the original building. Specifications called for two new 60 Smith oil-burning boilers and conversion of the older boilers to oil.

To determine the condition of the old boilers, the engineers decided that a careful examination should be made, and as the bridge wall sections were not to be used after conversion, they were broken and examined. Present at this inspection were representatives of the architect, heating engineers, heating contractor, insurance company and The H. B. Smith Co.

The sections showed even thickness of fine gray iron with no appearance of deterioration. Since these sections were located in the hottest part of the boiler, subject to the greatest wear, it was the unanimous opinion of those present that the town would be wise to use the old boilers along with the new ones.

The installation has now been through its first winter, and never at any time have more than three boilers been on the line, despite the fact that the heating load calls for the fourth boiler when necessary.

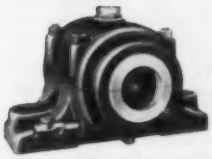
If Needham, back in '29, had "saved money" with a "20-year boiler," the town today would be *out* many thousands of dollars — in added maintenance, extra fuel and the new capital investment needed.

Now, because the town *looked ahead* in 1929, it can *look ahead* in 1955 to many, many more years of efficient heating service from its dependable two sets of twins. And the money saved can be spent where it's vitally needed today — *educating children,* not feeding, maintaining and replacing boilers.

H.B. Smith CAST IRON BOILERS

THE H. B. SMITH CO., INC., WESTFIELD, MASSACHUSETTS • Established 1853

WHEREVER QUIET IS REQUIRED



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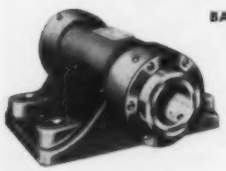
WATER-COOLED SLEEVOIL
Sleevoil Pillow Block, designed for industrial applications where high temperatures are encountered.

DODGE BRONZOIL
Capillary bronze bushing has capacity of one-third its volume in oil. Reservoir with close fitting wick around bushing provides ample lubrication. Both pillow blocks and flange units.

BRONZE BUSHED PILLOW BLOCK
Designed for arrangement No. 2 installations. Two bronze bushings of high lead content mounted in one cast iron housing. Special T-section rings for dependable lubrication.



BALL BEARING PILLOW BLOCK
For anti-friction installations. Two single row, deep groove ball bearings in one cast iron housing. Extended inner races carry the shaft.

CALL THE TRANSMISSIONEER
your local Dodge Distributor, for information about the entire Dodge line of bearings for fan and blower service. Look for his name in the Classified Telephone Directory under "Power Transmission Equipment." or write to the factory.

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FOR FAN AND BLOWER SERVICE

FOR INSTALLATIONS in hospitals, auditoriums, office buildings—wherever quiet operation is essential, Dodge offers the perfect answer to the bearing problem. Dodge manufactures a *complete line* of bearings for fan and blower service, all engineered and precision-built for exceptional quietness in operation.

The Dodge line has been developed in close cooperation with the manufacturers of fan and blower equipment, to meet the specialized requirements in this field, efficiently and economically. For complete information on Dodge fan and blower bearings see your Dodge Distributor—or write the factory.

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2. High base for more combustion space and elimination of high brick foundation.
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4. Green enamelled steel jacket lined with thick blanket of fibre glass—saves insulating time.
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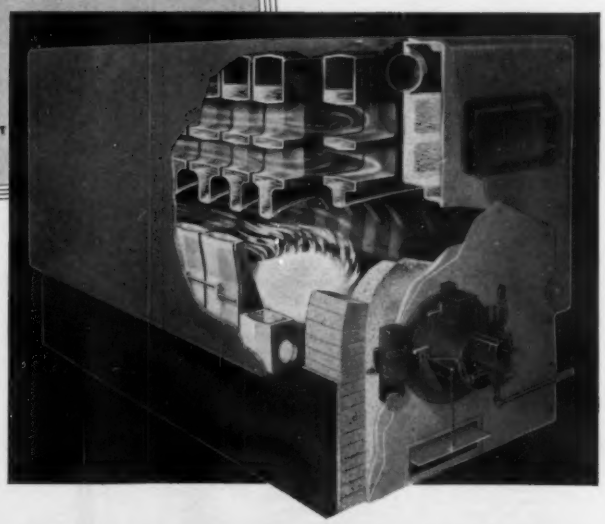
6. Large waterways for rapid, efficient water circulation.
7. Individual short draw rods for easy, strain-free assembly. Sectional construction for easier installation.



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Weil-McLain Series HR Heavy Duty Boilers effectively develop the economies obtainable with horizontal rotary cup oil burners. Their specialized design fulfills the two basic requirements of high operating efficiency—*ample combustion volume and a high percentage of primary heating surface!*

Send for catalog No. C-188—see the design, construction and operating features which make the Series HR Boiler a genuine advance in oil burning efficiency.

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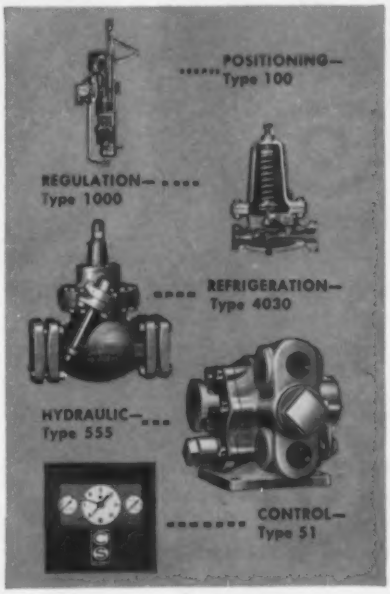
For an individual solution to *your* pressure problem, contact the Cash Standard pressure specialist in your area, or write for pressure problem analysis.

Some Applications Served by Cash Standard Pressure Products



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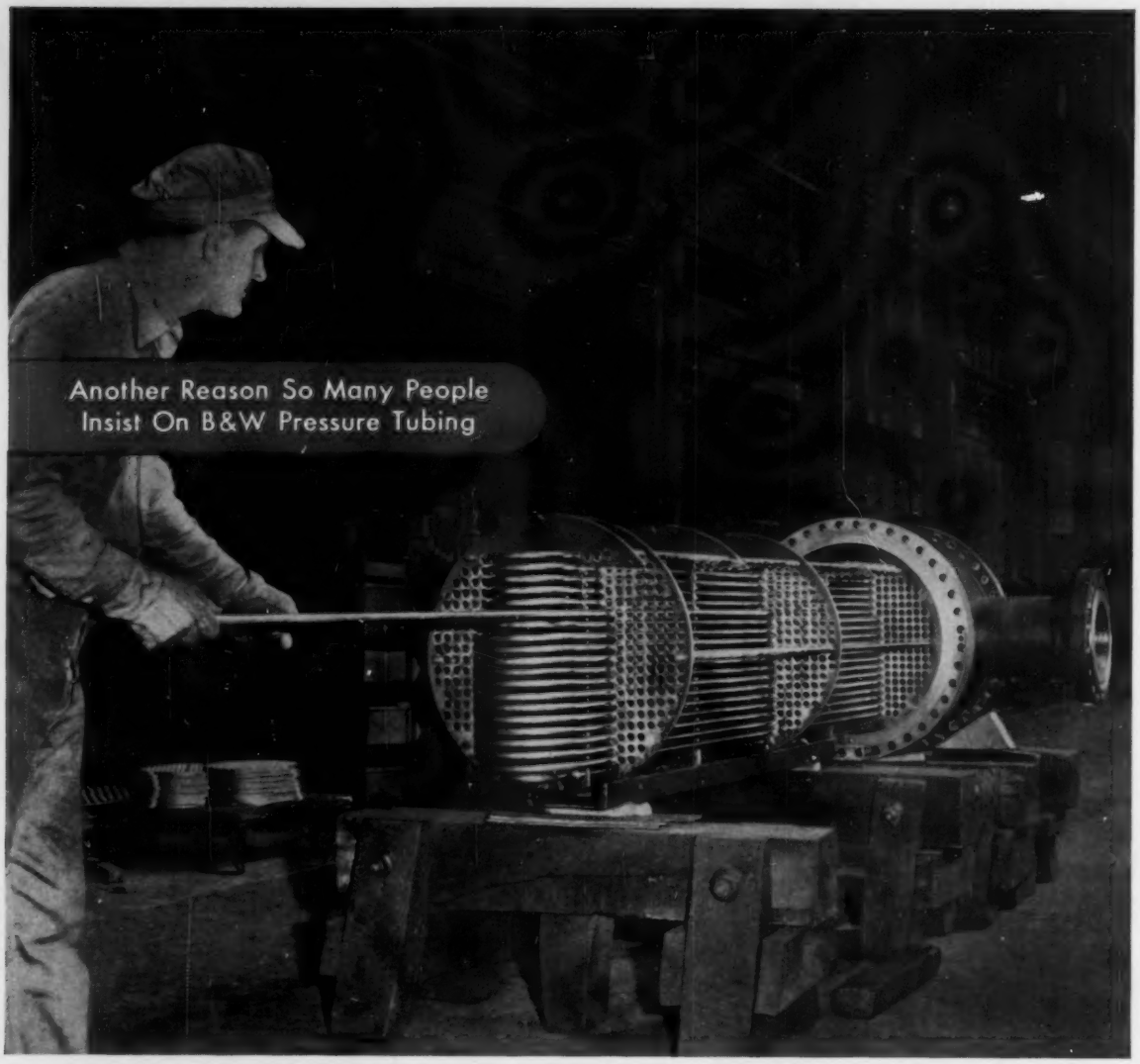

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For the complete story of how B&W Pressure Tubing can improve your operation, why not call in Mr. Tubes, your link to B&W. *Or write today for Bulletin TB-329.*

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Milwaukee, Wis.: Seamless Welding Fittings

TA-5022(P)

• *TECHNOLOGICAL PROGRESS will be marked in some 350 papers at the annual meeting this month of the American Society of Mechanical Engineers, celebrating its 75th anniversary.*

Just as industrial strength depends upon the continuous development of new materials and techniques, these, in turn, require new standards and revisions of old ones. Reflecting the progress in the field of piping are the current steel pipe specifications, S-values, and welding procedures for power piping, summarized in this issue in an article beginning on page 95.

Construction Activity Sets New Record

. . . nonresidential contracts up

NEW CONSTRUCTION activity increased to an all-time monthly high of $4 billion in September — latest month for which figures are available — to round out the most active quarter on record. According to the U. S. Departments of Commerce and Labor, the value of new work put in place during September brought the third quarter total to $11.9 billion, 9 percent more than the July-September 1954 period. After adjustment for seasonal factors, new construction activity in the third quarter of 1955 was at an annual rate of $41.8 billion, compared with actual outlays of $37.6 billion in 1954.

Commercial building continued at a record-breaking rate in September, exceeding the $300 million mark for the first time. Construction of churches and private industrial facilities was also greater than in any previous month.

The grand total of building and engineering contracts for September totaled $2,034,895,000, up 12 percent above 1954, according to the F. W. Dodge Corp.

Nonresidential building contracts amounted to $708,803,000, up 10 percent above the September 1954 total. ⫩

BOILER BANQUET is served to Myron Laws, Seattle department store executive, as he joins others inside firebox

WALL OF AIR will permit easy access to 1975 food store, yet it will effectively separate indoor and outdoor environments

Air Curtain to Replace Food Store Front

. . . predicted for 1975

A NEW TYPE of food store with the entire store front completely open is predicted for 1975 by the U.S. Chamber of Commerce. A continuous curtain of air — cold air in summer and warm air in winter — flowing from a continuous register in the ceiling to a grating in the floor will separate the outside and inside atmospheres.

The air curtain will be strong enough to prevent entry of outside air, yet shoppers will pass through it as easily as if it weren't there.

The new air curtain is illustrated in a new film released by the Chamber, titled "People, Products, and Progress: 1975." ⫩

Banquet in a Boiler Celebrates Installation

. . . of Seattle's largest

DIRECTORS of the Seattle Steam Corp. and their technical consultants recently celebrated the installation of a $1½ million boiler at the company plant. Dinner was served in the boiler firebox.

Twenty-seven persons arrived via a steel chute through the boiler's 3 ft burner opening. They dined in cool comfort, however, for the large boiler began operating two days later, producing steam at the rated capacity of 200,000 lb per hr.

The banquet, given by Bumstead-Woolford Co., supliers and installers

of the boiler, was the second to be held in a boiler of the plant. The first was in 1925 upon completion of the largest of the old boilers.

The new boiler, largest in Seattle, is 58 ft high, 23 ft wide, and 42 ft deep. Burners are equipped to use oil and natural gas interchangeably. ⫩

Add New Piping Alloys To Stainless Steels

. . . . . higher manganese content

TO ASSURE future supplies of austenitic stainless steels, research has resulted in several new alloys made with manganese in place of nickel, according to the Allegheny Ludlum Steel Corp. Others are still under development.

The first alloy contains 15 percent chromium, 15 percent maganese, and 1 percent nickel. This is generally considered to be a sheet and strip alloy. It has corrosion resistance about equal to the straight chromium grade, Type 430, and slightly inferior to chrome-nickel grades of stainless.

Another sheet and strip alloy, with a nominal composition of 17 percent chromium, 4 percent nickel, and 6 percent manganese, has the high strength and corrosion resistance, the good formability, and the easy weldability of the popular 17 percent chromium, 7 percent nickel Type 301. This type is resistant to atmospheric and most other corrosive conditions where Type 301 may be used.

Another stainless alloy, with 18 percent chromium, 5 percent nickel, and 8 percent manganese, is an austenitic alloy developed as an alternate for Type 302, and mechanical properties and corrosion resistance are similar to that material.

The manganese content reduces resistance to oxidation at elevated temperatures. Therefore, the 18-5-8 alloy is not being recommended by the company for applications at temperatures above approximately 1500 F in oxidizing atmospheres. ⫩

INDUSTRY RELICS — compressor of about 1920 and a heat operated fan of the 1890's — will be displayed at the Air Conditioning and Refrigeration Institute show in Atlantic City this month. Both are still in operating condition. They are shown here by Hy Jarvis, founder of the Recold Museum of Air Conditioning and Refrigeration Equipment and president of Refrigeration Engineering, Inc. ⫩

Business, Industry Find Air Conditioning Profit

. . . survey's show importance realized

HOW MANY business and industrial organizations have realized the importance of air conditioning?

According to John E. Haines, president of the American Society of Heating and Air-Conditioning Engineers, 50 percent of all the larger office buildings now are air conditioned, and virtually 100 percent of all new office buildings have air conditioning included at the time of construction.

A survey of 75 manufacturing plants in the New York area showed that $108 annually in wages is lost for each employee in a non-air conditioned building. The study indicated that 100 days in each year were so hot or humid that employees either slowed up or stopped work entirely during part or all of the day.

Absenteeism dropped 25 to 30 percent after the installation of air conditioning. Reduced turnover in personnel, lower cleaning costs, and increased productivity were also reported.

Most studies show that employee efficiency picks up 15 to 25 percent in air conditioned rooms. Some executives claim even higher gains.

In one industrial experiment, humidity was permitted to shoot up to 80 percent, and production fell off one-fourth almost immediately.

"Air conditioning is being installed so fast that it is impossible to keep accurate statistics, and it is anybody's guess how many factories are air conditioned," said Mr. Haines. ⫩

Largest Hotel Ballroom Air Conditioned? Yes!

. . . has exhibit space, too

SEVERAL TONS of moisture per hour are removed from the 20,000 sq ft ballroom, the 16,000 sq ft display hall, and other areas in the air conditioned new addition to the Sheraton-Park hotel, Washington, D.C., according to the Trane Co. In addition, cool, filtered air is provided.

The 350 ton system is so flexible that it can handle a crowd of 3000 or a gathering of 500. Two large fan systems and several package units comprise the system.

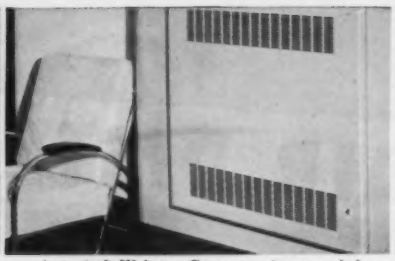
The air is cooled to a low dry bulb temperature and wet bulb temperature, then reheated to the temperature required to maintain comfortable conditions.

The compressor, which supplies chilled water at 40 F to all the cooling coils in the central fan systems, adjusts its cooling output automatically between 100 and 10 percent of capacity. ⫩

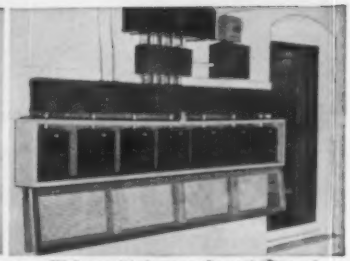
"Quote"

"Apathy has been the biggest stumbling block to school improvement."—*Committee for White House Conference on Education.*

Ground Plan of Eastern State Hospital, Knoxville, Tenn., showing widely separated buildings heated by Webster Moderator System. (Below) Main Building. Architects and Engineers for heating modernization: Baumann & Baumann, Inc. Heating Contractor: John F. Humphrey Co. — both Knoxville.



A typical Webster Convector is concealed behind this sturdy and attractive grille. All radiators in Webster Moderator Systems get steam at the same time and substantially in proportion to the need for steam. This balanced heat distribution is achieved with accurately sized metering orifices.



Webster Moderator Central Control Station at Eastern State Hospital. An outdoor thermostat controls 23,535 sq. ft. of installed direct radiation through control cabinet at top center. Seven Variators, below, give manual control in the seven major zones.

Eastern State Hospital, Knoxville, Tenn., built in 1884, modernized its heating with a 13-zone Webster Moderator System of Steam Heating. System operates through a single central control, provides double benefits: Gives greater heating comfort at lower fuel cost.

Steam heating has been completely modernized throughout this 71-year-old state mental hospital. Multi-zoned Webster Moderator Control now links widely separated buildings in an endless chain of heating comfort and fuel economy. Outdoor thermostat gives weather-controlled, continuous heating. Radiators are always pleasantly warm, never unpleasantly hot.

Seven Variators give manual control for quick warm-up or reduced heating in the seven major zones of Electronic Webster Moderator Control. Outlying buildings have separate Webster EH-10 Moderator Controls. Webster Convectors, concealed behind sturdy grilles, have key-operated valves for individual complete shut-off. In the men's dormitory, hot water heating through a heat exchanger is controlled for draft-free comfort by Webster Continuous Flow Control.

Want less over- and underheating? fast delivery when outdoor temperature falls? manual regulation when needed? balanced steam distribution? Ask your Webster Representative about Webster Moderator Controls, or write us.

Address Dept. HP-11

WARREN WEBSTER & COMPANY
Camden 5, N. J. Representatives in Principal U. S. Cities
In Canada, Darling Brothers, Limited, Montreal

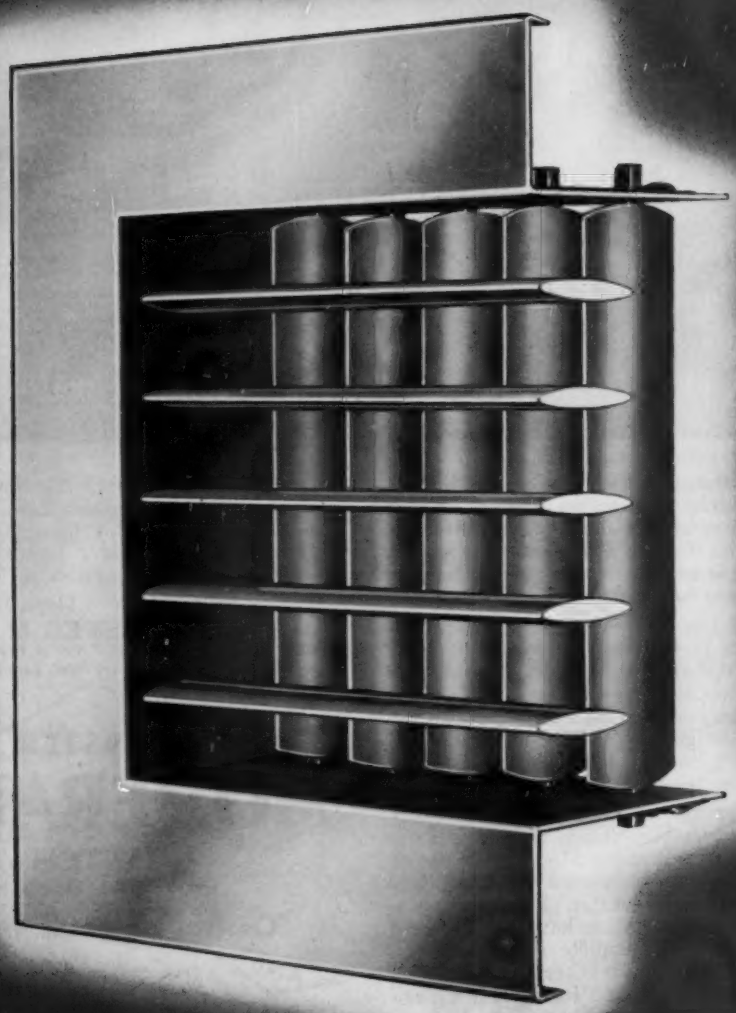
WEBSTER
MODERATOR
TRADE MARK REG. U.S. PAT. OFF.
SYSTEM
OF STEAM HEATING

"Controlled by the weather"

AND **Other Webster Heating Equipment includes Webster Steam Heating Specialties for heating and process applications; Tru-Perimeter Heating with Webster Walvecter or Webster Baseboard; Unit Heaters. Data on request.**

ROOM AIR DISTRIBUTION . . .

TITUS *ELIMINATES INSTALLING*



IS NOT COMPLICATED

50% OF GRILLE ENGINEERING & ADJUSTMENT PROBLEMS

NEW MORE AIR CONTROL BUILT-IN

By engineering MORE AIR CONTROL per square inch into each diffuser and grille . . . *right at the factory* . . . Titus simplifies all phases of grille *specification, selection, installation* and *adjustment.* Eliminates any necessity for special factory schooling or instruction at the contracting, engineering or tradesman level. Any workman can install a Titus grille without unbalancing the whole expensive system.

NEW MORE SIMPLE INSTALLATION

Install grille in 2 easy steps. (1) Fasten grille in place with screws. (2) Adjust louvers for correct air patterns. Titus *makes it easy, makes it simple* to obtain correct air patterns . . . patterns that give *maximum room comfort . . . from any air conditioning system.*

NEW MORE FLEXIBILITY OF ADJUSTMENT

Most important . . . any miscalculations that have crept in during the installation period may be simply and easily corrected by quick adjustment of streamlined Airfoil louvers. ADJUSTING IS DONE *WITHOUT* REMOVING GRILLES FROM WALLS. COSTLY TIME-CONSUMING "CALL BACKS" ARE ELIMINATED.

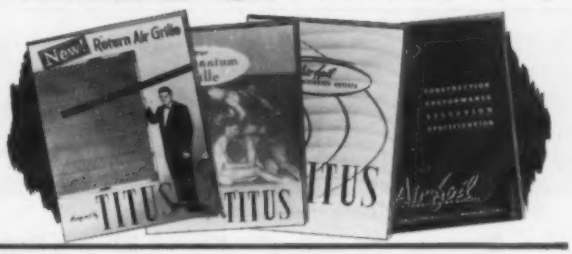
NEW SIMPLIFIED, FOOL PROOF DESIGN

All Titus grilles and diffusers are built under the most rigid, precision-controlled standards. They give finest air diffusing performance. Air control cannot be lost at the installation level. Titus grilles are so carefully constructed it is almost impossible to have anything but correct diffusion of air . . . no matter who installs or adjusts them.

SETS PERFORMANCE STANDARD FOR ENTIRE AIR CONDITIONING SYSTEM

Directs air where it is needed. Keeps uniform temperatures throughout room. Eliminates old-fashioned drafts . . . low level stratification. Truly controls comfort . . . *at the room level* . . . THE ONLY AREA WHERE THE UNIT'S ENTIRE HEATING OR COOLING PERFORMANCE IS JUDGED.

FREE CATALOGS



Get information on the complete line of Titus grilles now.
Order actual samples. Look at them. Hold them in your hands. Test them. See for yourself why Titus can save you money. Can give you better air diffusion performance . . . in every type of building where air conditioning is used.

TITUS MANUFACTURING CORP., WATERLOO, IOWA

Gentlemen: I wish to simplify my grille installation problems and to lower my grille installation costs. Please send me complete information on the following Titus grilles.

☐ Supply Grilles & Registers ☐ Return Air Grilles ☐ Volume Controllers
☐ Frames and Accessories ☐ Gymnasium Grilles

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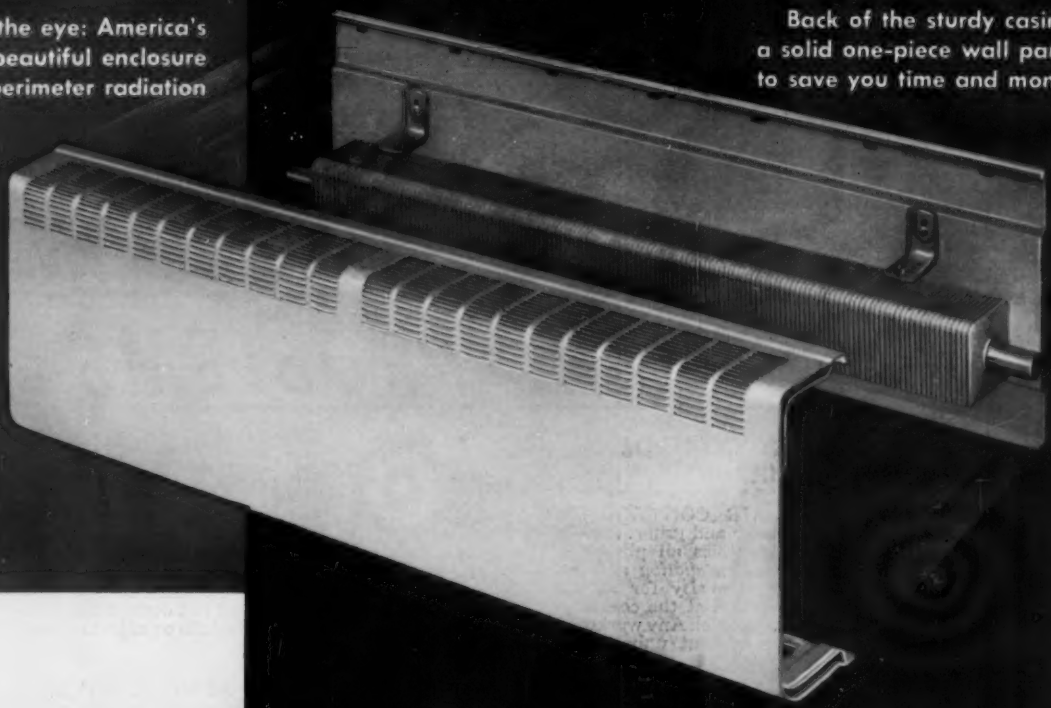
Sill-line: Beauty backed by VALUE

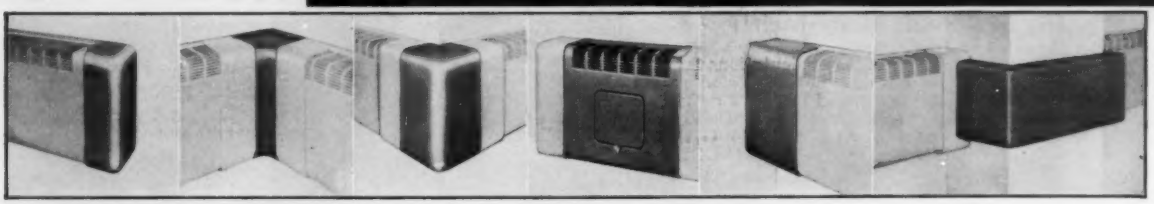
To the eye: America's most beautiful enclosure for perimeter radiation

Back of the sturdy casing: a solid one-piece wall panel to save you time and money



Built up to a standard, not down to a price

The heavier 16-gauge enclosure finished in baked enamel will forever remind you of its beauty and endurance. The standard one-piece back panel that covers raw walls and insures quick, rigid, true-alined installation more than pays its way in savings of time and face material.

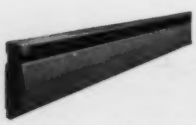


Most for the dollar

Nesbitt Sill-line Radiation is today's best buy in perimeter heating. It offers the most beauty, comfort and convenience for the dollar. For use with steam or hot water; capacities, 2.9 to 11.1 sq ft EDR. Five cabinet types; seven lengths of casing and element from 2′ to 8′. Complete accessories and sleeves—no cutting on the site.

Insist on Nesbitt

Make sure you get all the features Nesbitt Sill-line offers: one-piece back panel, sturdy 16-gauge enclosure, baked enamel finish, and a full range of matching accessories. Send for Publication 102.



Nesbitt Baseboard Radiation
Ask for Publication 272

Nesbitt Convectors
Publication 262

Gas-fired Unit Heaters
Publication 280

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Sill-line Radiation
is manufactured and sold by
John J. Nesbitt, Inc., Phila. 36, Pa.

"Open for Discussion"

• WE FOLLOW HERE each month the practice at engineering society meetings of providing an "open for discussion" period. You are urged to take part. Just address your comments to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

Check Cost of Valve Inspections Against Cost of Shutdowns in Maintenance

I AGREE with H. B. Wayne's comments and suggested maintenance program for valves, in the August HPAC. His comments, in my opinion, are very pertinent to this whole problem, and certainly nothing that he has stated can be improved upon.

There is, however, one factor upon which he does not touch, and that is the relative cost to the user of making the inspections and replacements which he recommends as compared to the cost of temporary shutdowns. Many situations in which temporary shutdowns are of no particular importance would indicate longer periods between inspection and maintenance.

In any event, Mr. Wayne's suggestion that a few spare control valves for rapid replacement be kept on hand is the best course of action for any extensive user of valves.

SYLVAN L. HANAUER
Consulting Engineer

Small, Portable Atomic Reactors For Heating, a Long Way Off

I READ with interest the article, *Atomic Boiler Being Developed For Year 'Round Air Conditioning*, in the July HPAC. The direction of research toward development of small, portable atomic reactors as heat sources for commercial, public and institutional buildings, automotive vehicles, and homes will ultimately be of great benefit to the progress of civilization.

The General Electric Company has announced the creation of an atomic power equipment department which will produce small reactors for research, or for isolated military bases where ordinary fuels are obtained only at very high costs. These will be engineered, manufactured and marketed as complete units, designed to be readily transported by rail or barge, or disassembled into major subassemblies and flown to location. However, these units will require considerable shielding and safety devices which might make the cost out of range of small commercial installations.

Based on current technology, I believe the author of the article might be a little overly enthusiastic about the soonness for the realization of his dreams because of the following factors:

1. The fission process produces heat from the deceleration of fission fragments, alpha and beta particles and absorption of gamma photons. Since all are present in considerable quantity, massive shielding is required to absorb the leakage radiation in order to make the process safe and maintainable. One of the greatest problems in the development of nuclear powered aircraft is reducing the weight of the shielding required to permit operation of such an aircraft.

Since no radiation free fission process is currently within view, all atomic reactors must continue to carry their mantle of protective shielding, weighing upwards of 60 tons, until that day when such a process might be possible. For this reason it is hard to foresee the portability and size discussed by the speaker right away, particularly those portions which apply to installation in existing equipment.

2. The very basis of atomic fission processes depends on maintaining a chain reaction for their continuity. As an alternative, heat can be extracted from the decay of radioactive waste, but this process is not fission. I believe what the author had in mind was that he foresees the day when the development of atomic processes and control devices will permit assembly of an atomic reactor device which is "inherently safe"; that is, one which is incapable of runaway power surges despite the failure of cooling systems, controls, or other reactor components.

R. T. JASKE
Engineering Department
General Electric Co.

Central Heating Outmodes War Dance Among Native New Zealanders

ALTHOUGH I was very interested in Professor F. W. Hutchinson's article, *Beer for the Gods*, in the May HPAC, I failed to see how the photograph at the beginning of the article pertained to the text.

The photograph shows members of the Arawa Tribe of the New Zealand Maoris performing a traditional "Haka" or dance of welcome on the Marae at Ohinemutu. The Maoris shown would probably be concerned to learn that they were being compared to primitive natives stupid enough to bury their beer in the ground instead of disposing of it in the more usual way.

To the contrary, the Maoris are a civilized people who in every day life wear European dress. However, for special occasions, they do put on their traditional

garments and give a display of Hakas and other dances.

Actually, the part of New Zealand in which the photograph was taken has a far greater interest for heating engineers than it might at first appear. Ohinemutu is in the center of the Rotorua area where there is considerable natural thermal activity in the form of hot springs, boiling pools and steam vents. Before the coming of the Europeans, the Maoris made considerable use of these for bathing and cooking purposes.

Early attempts were made by Europeans to harness the boiling pools, but as the number of pools was not sufficient for their needs and there were difficulties in making use of them, bore wells were drilled. From these wells an endless supply of super heated water is obtained which is used for central heating, hot water supply to greenhouses, and many industrial purposes.

The Spa Hotel at Taupo has such a heating system today. It obtains its heat from a geothermal bore which yields a supply of saturated steam at 75 psi. The steam is also used for cooking in open steaming ovens, for cleaning and sterilizing garbage cans, curing precast concrete goods, heating of creosote for treating fence posts and warming a greenhouse.

After the bore has given off heat for central heating and its other uses, the condensed steam is turned into swimming baths where it is mixed with other mineral water. For a short time the owner of the hotel used some of the steam to operate a reciprocating steam engine and generated enough electricity for the needs of the hotel.

W. L. COOKE, President
W. L. Cooke, Ltd., Heating Engineers
Auckland, New Zealand

● *No offense to the Maoris was intended by using the photograph. We used the picture (above, left) for illustrative purposes only. It is contrasted by a truer picture supplied by Mr. Cooke to show the Maori in more typical European dress and against*

Piping Materials, Practices

CERTAIN ACTIONS of the Sectional Committee B31 on the American Standards Code for Pressure Piping sponsored by The American Society of Mechanical Engineers, are published from time to time for the information of interested parties. While these do not constitute formal revision of the Code, they may be utilized in specifications, or otherwise, as representing the considered opinion of the Committee.

Pending revision of the Code for Pressure Piping, ASA B31.1-1955, the Sectional Committee has recommended that ASME, as sponsor, publish selected interpretations so that industry may take immediate advantage of corresponding proposed revisions. The following cases are published herewith as interim actions of Sectional Committee B31 on the Code for Pressure Piping and will not constitute a part of the Code until formal action has been taken by the ASME and by the American Standards Association on a revision of the Code.

Case No. 18

Inquiry: Is it permissible to use mechanical joints in cast iron piping covered by Section 3 on Refinery Piping Systems of the Code for Pressure Piping?

Reply: It is the opinion of the Committee that mechanical joints in accordance with American Standard A21.11 Specifications for a Mechanical Joint for Cast Iron Pressure Pipe and Fittings and the standards of the Cast Iron Pipe Research Association covering cast iron mechanical joints may be used in cast iron piping covered by Section 3 until such time as the Code is revised accordingly.

Case No. 19

Inquiry: Is it permissible to use cast iron pressure pipe in accordance with ASTM specification A377 Specification for Cast Iron Pressure Pipe for cast iron piping covered by Section 3 on Refinery Piping Systems of the Code for Pressure Piping?

Reply: It is the opinion of the Committee that, in view of the cancellation of ASTM Specification A44, cast iron pipe in accordance with ASTM Specification A377, Specifications for Cast Iron Pressure Pipe, may be used in cast iron piping by Section 3 until such time as the Code is revised accordingly.

The applicable American Standards as stipulated by A377 are:

A21.2 Cast Iron Pit Cast Pipe for Water or Other Liquids

A21.3 Cast Iron Pit Cast Pipe for Gas

A21.4 Cement Mortar Lining for Cast Iron Pipe and Fittings

A21.6 Cast Iron Pipe Centrifugally Cast in Metal Molds for Water or Other Liquids

A21.7 Cast Iron Pipe Centrifugally Cast in Metal Molds for Gas

A21.8 Cast Iron Pipe Centrifugally Cast in Sand Lined Molds for Water and Other Liquids

A21.9 Cast Iron Pipe Centrifugally

the background of a cast iron radiator that is supplied with natural steam from a geothermal bore.

THE EDITORS

Consider Economics, Design Ease and Human Error in Sizing Expansion Tanks

AUTHORS Ray C. Chewning and Robert W. Peterson are to be commended for their excellent article, *Consider Pump Heads for Adequately Sizing Expansion Tanks*, in the July HPAC.

The article is of fundamental interest to the hot water heating industry because it is concerned with a very important basic fact. That fact is that the compression tank *location* relative to the pump determines how pump operation will affect system pressure.

It has been our experience, in dealing with this subject, that the architect, engineer, and contractor are unwilling to accept the premise that compression tank location is of any importance in establishing system pressure unless a complete explanation is provided. It is our belief that Mr. Chewning's and Mr. Peterson's valuable work will not be accepted until such an explanation has been made.

The authors' analysis of the problem is admirable. However, it is not, in our opinion, complete since questions of economics, of design ease, and of providing against human operating error have not been discussed.

Three basic types of inter-relationships of pump, compression tank, and boiler are covered in the article. Of the three, the system showing the pump discharging hot water from the boiler and compression tank is, in our opinion, the most acceptable.

Any closed hot water heating system must operate within a certain fixed pressure range. The operating pressure range is determined by the system initial fill pressure and by the boiler pressure rating — relief valve setting. The difference between the initial and final pressures is generally established at a figure such that very large tanks are avoided and which will permit some latitude in design and operation.

For the system in which the pump is pumping away from the boiler and compression tank, the minimum rated boiler pressure will be established by adding the system static pressure *only* to the minimum operating pressure range. This allows, in all cases, minimum pressure rated boilers and tanks, minimum sized compression tanks and a maximum operating pressure range.

Both of the other systems in the article — pump discharging into boiler — require that the minimum

Okayed by Committee

. . . pending code revision

Cast in Sand Lined Molds for Gas
Case No. 20

Inquiry: May electric fusion welded austenitic stainless steel pipe conforming to ASTM Specification A358 Electric Fusion Welded Austenitic Chromium-Nickel Alloy Steel Pipe for High Temperature Service be used under Section 3 on Refinery Piping Systems of the Code for Pressure Piping?

Reply: It is the opinion of the Committee that electric fusion welded austenitic stainless steel pipe complying with the requirements of ASTM Specification A358 may be used provided the following requirements are met:

a) The joint efficiency shall be 85 percent for material supplied in accordance with the specification.

b) The joint efficiency shall be 100 percent for piping in which the longitudinal welds are 100 percent radiographed.

c) The heat treatment shall be a matter of agreement between the purchaser and the vendor based on the intended service.

d) Stresses shall conform to A312 with the appropriate joint efficiency factor.

e) Radiographed in conformance with requirements of Par. 635(b)(2).

Case No. 21

Inquiry: May seamless steel pipe having 70,000 psi minimum tensile strength be used in the construction of piping under the rules of Section 1 of this Code?

Reply: It is the opinion of the Committee that carbon steel seamless pipe having 70,000 psi minimum tensile strength may be used for Code construction under Section 1. The pipe shall be manufactured in compliance with the requirements of ASTM Specification A-106 Seamless Carbon-Steel Pipe for High Temperature Service with the following modifications:

a) The carbon content shall not exceed 0.32 percent by ladle analysis or 0.35 percent by check analysis. Other chemical elements shall be as listed for A-106 Grade B.

b) The physical properties shall meet the following minimum requirements:

Tensile strength, psi	70,000
Yield point, psi	40,000
Elongation in 2 in. in the longitudinal direction of a standard round 2 in. gage length, percent minimum	20

c) The flattening test shall be as required for A-106 Grade B.

d) The grade designation for marking shall be "70,000 T.S. A-106 Grade C".

e) The maximum allowable stresses are:

−20 to 650 F	17,500 psi
700 F	16,600 psi
750 F	14,750 psi
800 F	12,000 psi

boiler pressure rating be established by adding the system static pressure to the minimum operating pressure range *plus* the pump head. In all cases the pressure rating of the boiler must be the maximum, the compression tank must be large, and a minimum operating pressure range will usually be established.

Minimum pressure rated boilers and compression tanks provide a cost advantage and are obtained by pumping away from the boiler and compression tank.

Maximum operating pressure range is also obtained by pumping away from the boiler and compression tank and is important in the operation of the system.

System design problems are simplified by pumping away from the boiler and compression tank. Because pump head does not have to be added to the static pressure to determine the initial fill pressure, currently used standard methods of sizing tanks are acceptable. The additional design error of adding the pump head, with its inherent design inaccuracy due to factors beyond the control of the engineer, is also avoided.

The question of human operating error should also be discussed, in my opinion. Apparently, most heating system operators dislike operation of a system at high pressure and prefer to operate at as low a pressure as possible — fill pressure just sufficient to fill the system. When the system is designed so that the pump discharges hot water away from the compression tank and boiler, such a condition is satisfactory. This is true because the system pressure will automatically rise in all parts of the system except at the boiler when the pump starts. Consequently, there can be no air suction into the system and, if the compression tank is sized according to presently accepted procedure, there is no possibility of the system water boiling.

On the other hand, on a system in which the pump discharges into the boiler and compression tank, the engineer may correctly specify the higher fill pressure required — by adding pump head to static fill head — only to have the system fail to operate properly because the operator may not fully understand how system pressures react to pump operation.

The authors state that systems connected so that the pump discharges away from the compression tank and boiler are the exception rather than the rule. On small residential systems this is true. However, on potential trouble systems — high static head, high pump head systems — it is our belief that the reverse is true. Engineers have learned by experience, and we have advocated for the past 15 years, that on large high pump head systems, the pump should be placed so that it pumps away from the boiler and the compression tank.

G. F. Carlson
Engineering Dept.
Bell & Gossett Co.

The Authors' Reply—Mr. Carlson's comments should not be considered as comments on the article itself except that reference is made to its subject matter.

The article presented the hydraulics and mathematics involved in the proper sizing of expansion tanks. We wrote it because an extensive study of the literature on the subject revealed that existing material made no mention of the effect of pump location and head on system pressure. Actually, the fact that the effect of location and pump head was completely ignored in the literature would lead designers to believe that the matter was of no importance.

The article did show the effect of pump location and head on the size of the expansion tank. It presented the designer with a procedure for accurately establishing the size of the expansion tank for various pump locations and heads so its effect on cost and operation in any particular system could be evaluated.

A statement to the effect that no recommendation regarding the best location of the pump was contained in the summary of the article. The recommendation of a specific location of the pump or pumps is the subject of Mr. Carlson's comments. To really do that subject justice, considerable editorial space would be needed. Even then, it is doubtful that a convincing case could be made for a particular pump location to cover all situations because of the many conflicting considerations which are difficult to evaluate in terms of first cost, ease of operation, and comfort conditions maintained by the system. The subject is not as simple as the mathematics and hydraulics involved in sizing expansion tanks.

In other words, a law not in the physics books, but enunciated recently as Kroeker's law, would apply. Slightly amended, it is "Things are not as simple as they seem."

Ray C. Chewning
Robert W. Peterson
J. Donald Kroeker and Assoc.
Professional Engineers

Mount Aftercooler Near Compressor To Combat Pulsation, Vibration

My hat is off to S. A. Herrick on his splendid article, *Do You Make These Mistakes in Piping Compressed Air?*, in the August HPAC.

Maybe my ideas are old fashioned, but I like to see the aftercooler and receiver on solid concrete and placed as "close to the compressor as possible," as Mr. Herrick points out. Otherwise, it does not take harmonic pulsation or vibration very long to loosen the tube bundle in an aftercooler.

Where there are eight or 10 compressors involved, sometimes all of them are connected into a common header discharging into remotely located aftercoolers. On the drawing board this looks practical, but in actual use, the resulting vibration may be harmful to both equipment and building.

James C. Bishop
Engineer

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Making room air conditioners with SIL-FOS 5

SIL-FOS 5 wire rings by the thousands are used in assemblying condensers and evaporators of FEDDERS room air conditioners, made by Fedders-Quigan Corp., Buffalo, N. Y. This low-temperature silver brazing alloy consistently makes the permanently leak-tight joints on which the conditioners' performance and service life largely depend. At left – Return bends, assembled on condenser tubes with SIL-FOS 5 rings preplaced, are brazed on automatically timed city gas-air burner setup – 3 rows (40 joints) in less than 1 minute.

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Here's what KAM Water Heater Mfg. Co., Brooklyn, N. Y. says about SIL-FOS after 15 years of experience with it in brazing copper tanks: "SIL-FOS proved ideal because it makes high-strength joints at 1300°F. This temperature plus the speed with which this free-flowing alloy can be applied, result in a minimum annealing effect on the cold rolled copper we use. In addition, joints are very ductile, thus can withstand pulsation, expansion and contraction."

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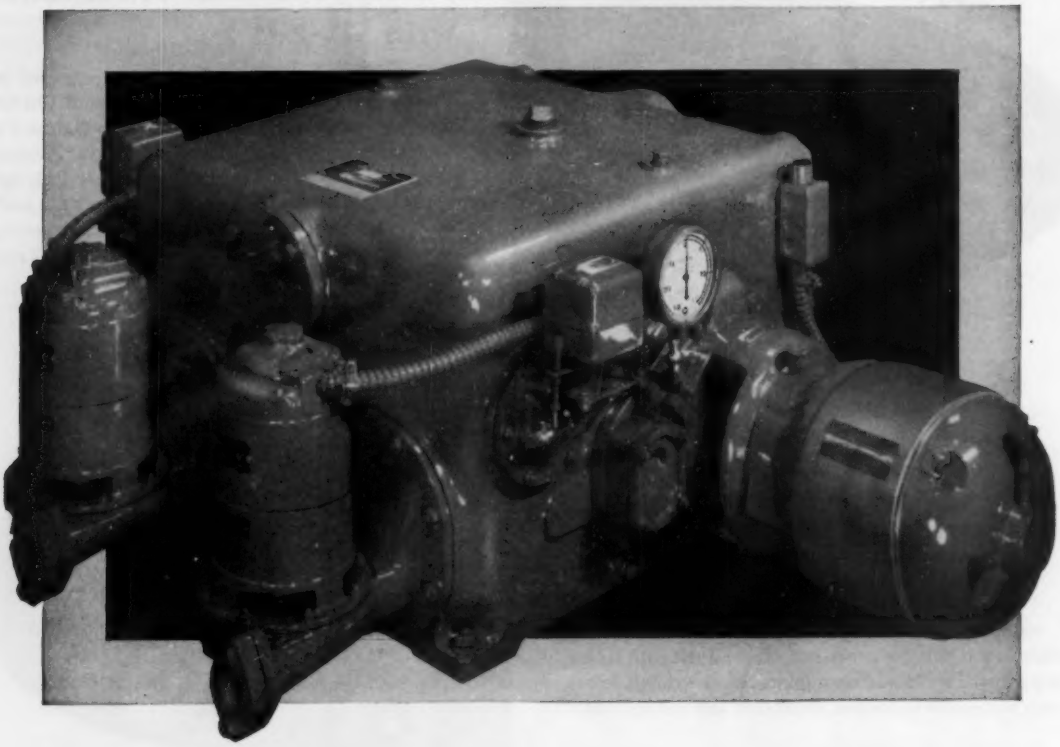

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- Increased air capacity induces rapid system response without wasteful overheating.
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- Flexibility permitting addition of radiation without changing basic pump installation.
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Latest Steel Pipe Specifications, S-Values, and Welding Procedures Summarized for Power Piping

. . . *including changes in new code ASA B31.1-1955*

• **Following the publication of a previous article by the author about steel pipe specifications — HPAC for January 1946 — readers have asked if the original article had been revised to include subsequent specification changes. The answer, until now, was, "No." However, with the task of revision now complete, here, in easy to use, systematized form, is the latest information on this subject. S-values and welding procedures are also discussed.**

By Sabin Crocker

Mechanical Engineer, Ebasco Services, Inc.

The author is Vice Chairman of the American Standards Association's Sectional Committee B31 on Code for Pressure Piping. He is also a member of HPAC's board of consulting and contributing editors.

VARIOUS compositions of carbon and alloy steel materials are available to choose from in specifying power piping. Most of these materials are offered made up in any one of the several varieties of welded seam construction in use as well as in the form of seamless or forged and bored pipe. Further variations arise from choice of steel melting practice, completeness of chemical composition and physical properties specified, and from the thoroughness of inspection and testing desired. These are the features that distinguish one material specification from another and which constitute the basis on which committees of the American Society of Testing Materials formulated the several specifications which are commonly used for power piping.

For operation at elevated temperatures, consideration also has been given to the high temperature properties of the respective materials as determined by long time tests for creep strength and stress-to-rupture. High temperature properties plus the other factors were weighed by the code committees in setting the allowable stresses — S-values — for the respective piping materials at different operating temperatures as given in the American Society of Mechanical Engineers' Power Boiler Code and the Power Piping Section of the American Standard Code for Pressure Piping.

All of the foregoing factors influence cost as well as quality and hence enter into the rational selection of material for each job. Since the engineering data needed for making such selections is scattered through two codes, several ASTM specifications, and recommended practices of the American Welding Society, it appears that a consolidated table wherein specification data and S-values are abstracted and presented together and associated with welding P-numbers should serve a useful purpose. This was originally prepared by the author nearly ten years ago, resulting in the article and table which appeared in the January 1946 HPAC. Since that time the introduction of new materials and processes, the regrouping of alloys in new ASTM specifications, and the upward revision of S-values have made the original article obsolete. In response to requests from several HPAC readers, the author has prepared the present article and accompanying tables to summarize present day conditions, including changes contained in the new edition of the Piping Code, ASA B31.1-1955.

While the data in Table 1 was current at the time this article was written, the specifications and codes from which the data was abstracted are frequently revised. Furthermore, there are some differences and distinctions too minor to warrant abstracting. Hence, Table 1 should be considered in a qualitative sense only. For values to be used in actual design, the latest issues of codes and specifications should be consulted.

Some idea of the purposes for which the several specifications are suited can be gathered from their titles with condensed scope clauses as presented in Table 1. In general, the order of listing specifications follows the sequence of the ASTM numbering system and merely reflects the succession in which the specifications were issued. This order seems preferable to attempting to have the sequence follow an ascending quality scale, because so many factors are involved that it is impracticable to say that one specification necessarily represents a better product from every angle than does some other specification. However, the carbon steel specifications were issued in an earlier sequence before the alloy steel specifications appeared. In some cases, specifications for like materials have been grouped together in Table 1 regardless of the number sequence.

1. What Determines Suitability of Pipe Material?

In general, the quality of the product is reflected in the extent to which chemical composition and physical properties are specified. It is immediately evident from Table 1 which specifications have sufficient requirements to define adequately what the product is like and to assure obtaining reasonable uniformity of quality. Each length of every kind of pipe made must be capable of succesfully withstanding a hydrostatic test considerably in excess of its allowable working pressure without splitting or developing leaks. In the case of pipe for "ordinary uses," such as A120, this is the only test applied.

Further indications of quality are the process by which the steel is made and the melting practice. By "process" is meant the Bessemer, open-hearth, electric furnace, or duplexing process of manufacture used in producing the steel. "Melting practice" refers to whether the steel is an "open" or "rimmed" steel, or whether it is "killed" or deoxidized during the manufacturing process. "Killed" steels are superior in many respects, among other things being of more uniform structure and better adapted to cold bending and severe hot forming operations.

Both aluminum and silicon are commonly used together as deoxidizers, and each has a specific effect on the final product. The aluminum tends to give a fine grained steel which behaves well on rolling but has poor resistance to graphitization in service at elevated temperature.

The silicon, on the other hand, tends to give a coarse grained steel having superior strength at elevated temperatures and less susceptibility to graphitization. Hence, it is sometimes specified that a steel shall be "killed with a preponderance of silicon," and a requirement is set as to the minimum amount of silicon which must be present on analysis. This requirement, however, does not preclude the use of an excessive amount of aluminum from the standpoint of graphitization, and more specific restrictions should be considered in ordering new pipe if carbon steel is to be used for temperatures above 775 to 800 F or carbon-moly above 900 F.

S-Values Tabulated

Another preliminary slant on the purposes for which the several specifications are suited can be obtained from the allowable stresses or S-values at different temperatures listed in Table 1 for the various kinds of material. The S-values are the maximum allowable stresses at different operating temperatures set by code committees for use in the formulas for computing the thickness of pipe wall required with respect to bursting stress due to internal pressure.

In the Code for Pressure Piping, the S-values in the hot and cold conditions also are used in a formula for computing the allowable stress range for a combination of longitudinal internal pressure stress with bending stress due to expansion and dead weight between supports. Tabulating these S-values on the same sheet with the chemical compositions, physical properties, and other characteristic information pertaining to each grade of material helps to make its salient features distinguishable from the corresponding features of other grades. For instance, no S-values have been provided in the codes for A120 pipe above 450 F, which is deemed to be the top temperature for A120.

Seam Efficiency Considered

The joint or seam efficiency possessed by each kind of pipe was considered by the code committees in setting the S-values. Seamless pipe, being without a longitudinal joint, naturally has an efficiency of 100 percent. Electric resistance welded pipe is ordinarily rated at 85 percent joint efficiency, but S-values equal to the corresponding seamless grade may be used under the Piping Code for applications where the temperature is below 650 F and where the pipe is subjected to supplementary tests and/or heat treatments which demonstrate the strength characteristics of the weld to be equal to the minimum tensile strength specified for the pipe.

Electric fusion welded A155 pipe, where the quality of welding is thoroughly tested, is allowed a joint efficiency of 90 or 95 percent under the Piping Code, depending on whether the longitudinal seam is radiographed. Class 1 A155 pipe can be made acceptable under the Boiler Code if the material and welding are passed by a certified inspector and radiography is done according to Code requirements.

Electric fusion welded A139 pipe made under less exacting requirements is given a joint efficiency of only 80 percent, the same as lap welded pipe and is not recognized for use under the Boiler Code. Butt welded pipe has the lowest joint efficiency of all, 60 percent, which is in keeping with the strength of that kind of seam. See S-values in Table 1.

Carbon Steel Pipe for Ordinary Uses

Among the problems involved is the existence of half a dozen specifications covering pipe materials suitable for ordinary service, but with no well defined rules as to when, or under what conditions, each one is more suitable than another. Leaving out specifications for nonferrous pipe and other special materials not generally applicable to power piping, this point boils down to choosing between A53, A120, A134, and A139 — see Table 1. Following is a review of their distinguishing features:

Specification A120 is the lowest grade of steel pipe for which there is an ASTM specification. No physical tests are specified beyond a hydro-

static test, and there are no chemical requirements whatsoever except requirements for galvanizing where this is desired. As stated in the scope paragraph, A120 pipe is intended for "ordinary uses in steam, water, gas, and air lines, but is not intended for close coiling or bending, or high temperature service." This is the "common or garden variety" of pipe purchased from jobbers' stock without a pedigree.

That A120 pipe is at the bottom of the scale for steel pipe also is evident from the fact that it has the lowest S-values assigned any kind of steel pipe in the respective grades, and that no S-values are given for temperatures above 450 F. Butt welded pipe may be furnished under A120 in sizes from 1/8 in. up to and including 4 in. in "standard weight" and "extra strong" thicknesses, and up to 3 in. "double extra strong." Lap welded pipe is not made in sizes below 1¼ in. Electric welded and seamless are made in the full size range. Either black or hot dipped galvanized pipe is available under this specification.

The next better quality of steel pipe for ordinary uses is electric fusion welded covered by ASTM Specification A139, which is made with either straight seam or spiral seam from plate of pipe mill grade. This kind of pipe is furnished in Grades A and B in sizes 4 in. and larger, and in wall thicknesses not exceeding 5/8 in. S-values have been assigned in the Piping Code for temperatures not exceeding 750 F.

Straight seam or spiral seam welded pipe in diameters 16 in. and larger and in thicknesses up to ¾ in. can be ordered to ASTM Specification A134, with reference to certain ASTM plate specifications. Chemical requirements consist of maximum limits on phosphorus and sulphur, and physical properties are specified for Grades A, B, C, and D. A134 pipe is used to a limited extent for power piping and has been assigned S-values for temperatures up to 650 F. The principal use for A134 and A139 welded pipe, however, is for underground gas, oil, or water lines; and for such purposes the purchaser usually specifies a protective coating.

Carbon Steel Pipe for Intermediate Uses

Coming between pipe for "ordinary uses" and pipe suitable for "high-temperature" service, there is an intermediate kind adapted to coiling, bending, flanging, and other special purposes, and suitable for fusion welding. Such pipe is satisfactory for intermediate uses in power piping at service temperatures up to 750 F. The two principal ASTM specifications in this field are A53 and A135, as discussed below.

Specification A53 covers black and hot dipped galvanized steel pipe which may be butt welded, lap welded, electric resistance welded, or seamless. Butt welded pipe is not made in nominal sizes larger than 4 in. and is not intended for flanging. Lap welded pipe is not made below 1¼ in. size. Electric welded and seamless are made in the full size range. When seamless or electric resistance welded pipe is ordered for close coiling, cold bending, or for forge welding, Grade A should be specified rather than Grade B. The chemical requirements of this specification cover only the maximum phosphorus content, aside from the fact that a carbon maxmium of 0.13 percent is set for resistance welded pipe of 1/8 and ¼ in. nominal size. The tensile requirements and bending and flattening test of A53 are good, but only one of these tests has to be made on one length of pipe from each lot of 500 lengths or fraction thereof in each size. Hence, these tests are not so searching as those specified under the optional supplementary requirements of A106, where transverse tensile and flattening tests may be made on both ends of every length of pipe if specified in the order.

Often, seamless A53 pipe is fundamentally identical with A106 pipe but has not been subjected to all the physical tests and chemical analyses required by A106. Hence, where A106 pipe is desired but none is available, it is sometimes possible to locate A53 pipe in stock and give it sufficient tests to demonstrate whether or not it meets A106 requirements.

Although the Power Section of the Code for Pressure Piping and the Boiler Code both show S-values for some types of welded and seamless carbon steel pipe up to 850 or 900 F, they include cautionary notes warning of the possible formation of graphite in carbon steel with prolonged exposure to temperatures in excess of 775 to 800 F, particularly where welded construction is used. Silicon killed low aluminum carbon steel has both a higher creep strength and a greater resistance to graphitization than has steel killed with a preponderance of aluminum. Even so, it is no longer recommended for use at temperatures above 775 F to 800 F with welded construction. Before the susceptibility of carbon steel and carbon molybdenum steel to graphitization was discovered in 1943, considerable carbon steel piping was installed for operation at superheated steam temperatures of 800 to 900 F. Later, much of this pipe had to be replaced or else have welded joints either removed and rewelded, or heat treated to put the graphite back into solution. The two later alternatives give only temporary relief.

Specifications A53 and A135 include Grade A and Grade B electric resistance welded steel pipe 30 in. and under in diameter. Only Grade A is adapted to flanging and bending. The suitability of electric resistance welded pipe for various purposes is somewhat dependent upon its dimensions, properties, and conditions of service, so that the purpose for which the pipe is intended should be stated in the order. The Code for Pressure Piping and the Boiler Code Committees have assigned S-values to electric resistance welded pipe for temperatures up to 750 F and 900 F, respectively, based on a joint efficiency of 85 percent.

(*Continued on page* 100)

TABLE 1—POWER PIPING CONSOLIDATED TABLE of chemical compositions, physical properties, allowable stresses, and welding P-numbers is based on specifications of the American Society for Testing Materials. Boiler Code and Piping Code S-values are identical except where otherwise noted. Welding P-numbers are the same in the two codes

Welding P-No.	Type and grade of pipe	Steel melting process	Ferritic or austenitic	Chemical Composition, Percent on Check Analysis: Carbon, range or maximum	Manganese, range or maximum	Phosphorus, maximum	Sulphur, maximum	Silicon	Nickel	Chromium	Molybdenum	Other elements	Physical Properties: Tensile strength, psi	Yield point, psi	Minimum Elongation in 2 in. or basic, percent (Note 1)	Allowable Stresses (S-Values), psi, for Temperatures Not to Exceed (Note 2): -20 F to 650 F	700 F	750 F	800 F	850 F	900 F	950 F	1000 F	1050 F	1100 F	1150 F
A53	Black and hot dipped galvanized welded and seamless carbon steel pipe intended for bending, flanging and other special purposes and suitable for fusion welding																									
No. 1	BW	OH or EF	F			0.080							45,000	25,000	20 in 8"	6,750										
No. 1	LW	OH or EF	F			0.080							45,000	25,000	20 in 8"	9,000										
No. 1	EHW Gr A	OH or EF	F	See also A135		0.050	(0.060)						48,000	30,000	35	10,200	9,900	9,100								
No. 1	EHW Gr B	OH or EF	F	See also A135		0.050	(0.060)						60,000	35,000	30	12,750	12,200	11,000								
No. 1	S Gr A	DAB	F			0.110		0.10 to 0.30					48,000	30,000	35	12,000	11,650	10,700	9,000	7,100	5,000					
No. 1	S Gr B	DAB	F			0.110		0.10 to 0.30					60,000	35,000	30	15,000	14,350	12,950	10,800	7,800	5,000					
No. 1	S Gr A	OH or EF	F			0.048							48,000	30,000	35	12,000	11,650	10,700	9,000	7,100	5,000					
No. 1	S Gr B	OH or EF	F			0.048							60,000	35,000	30	15,000	14,350	12,950	10,800	7,800	5,000					
A83	Type A low-carbon seamless steel boiler tubes (and small diameter pipe)																									
No. 1	S Low Carb.	OH or EF	F	0.06 to 0.18	0.27 to 0.63	0.048	0.058				CU optional 0.18 to 0.35		(47,000)			11,750	11,450	10,550	9,000	7,100	5,000					
A106	Seamless carbon steel pipe for high temperature service suitable for bending, flanging and similar forming operations and for fusion welding. (Optional supplementary requirements)																									
No. 1	S Gr A	OH or EF	F	0.25	0.27 to 0.93	0.048	0.058	0.10 min.					48,000	30,000	35	12,000	11,650	10,700	9,000	7,100	5,000					
No. 1	S Gr B	OH or EF	F	0.30	0.29 to 1.06	0.048	0.058	0.10 min.					60,000	35,000	30	15,000	14,350	12,950	10,800	7,800	5,000					
No. 1	S Gr C	OH or EF	F	0.35	0.29 to 1.06	0.048	0.058	0.10 min.					70,000	40,000	30	17,500	16,600	14,750	12,000							
A120	Black and hot dipped zinc coated (galvanized) welded and seamless carbon steel pipe for ordinary uses in steam, water, gas and air lines but not for close coiling, bending, or high temperature service																									
No. 1	BW	AB	F	None specified.								Hydrostatic testing only				5,700										
No. 1	LW or EW	AB, OH,	F	None specified.								Hydrostatic testing only				7,600										
No. 1	S	EF		None specified.								Hydrostatic testing only				9,600										
																At 450 F max. temperature. Higher values below 450 F										
A134	Electric fusion (arc) welded carbon steel plate pipe, sizes 16 in. and over, for conveying liquid, gas or vapor. (Note 3)																									
No. 1	A245 Gr A		F	OH + EF		OH + EF	OH + EF				CU optional 0.20 min.		48,000	25,000	21 to 27*	8,000										
No. 1	A245 Gr B		F	0.25		0.04	0.05						52,000	30,000	20 to 25*	9,600										
No. 1	A245 Gr C			AB 0.10		AB 0.11	AB 0.06						55,000	33,000	18.5 to 23.5*	10,100										
No. 1	A283 Gr A	OH or EF	F				0.083				CU optional 0.18 min.		45,000	24,000	30	8,300										
No. 1	A283 Gr B	OH or EF	F				0.083						50,000	27,000	28	9,200										
No. 1	A283 Gr C	OH or EF	F			Acid 0.075 Basic 0.05	0.083						55,000	30,000	27	10,100										
No. 1	A283 Gr D	OH or EF	F				0.083						60,000	33,000	24	10,100										
																Note * -- These are minimum values (not a range) depending on the thickness of plate used.										
A139	Electric fusion (arc) welded carbon steel pipe, straight seam or spiral seam, 4 in. and over in diameter, for conveying liquid, gas or vapor. (Note 3)																									
No. 1	Grade A	OH or EF	F		0.24 to 1.06	0.050	0.060						48,000	30,000	35	9,600	9,250	8,300								
No. 1	Grade B	OH or EF	F	0.34	0.24 to 1.06	0.050	0.060						60,000	35,000	30	12,000	11,350	9,950								
A179	Seamless cold drawn low carbon steel heat exchanger and condenser tubes (and small diameter pipe)																									
No. 1	S Low Carb.	OH or EF	F	0.06 to 0.18	0.27 to 0.63	0.048	0.058									11,750	11,450	10,550	9,000	7,100	5,000					
A192	Seamless carbon steel boiler tubes (and small diameter pipe) for high pressure service																									
No. 1	S Low Carb.	OH or EF	F	0.06 to 0.18	0.27 to 0.63	0.048	0.058	0.25 max.					(47,000)	(26,000)	(35)	11,750	11,500	10,700	9,000	7,100	5,000					
A210	Medium carbon seamless steel boiler and superheater tubes (and small diameter pipe)																									
No. 1	S Med. Carb.	OH or EF	F	0.35	0.80	0.048	0.058	0.10 min.					60,000	37,000	25	15,000	14,350	12,950	10,800	7,800	5,000					
A213	Seamless alloy steel boiler, superheater, and heat exchanger tubes (and small diameter pipe)																									
A312	Seamless and welded austenitic stainless steel pipe. (Optional supplementary requirements). (No filler metal added with welded seam pipe)																									
A358	Electric fusion welded austenitic chromium-nickel alloy steel pipe for high temperature service. (Optional supplementary requirements). (Optional radiographic examination permits S-Values equivalent to seamless)																									
A376	Seamless austenitic steel pipe for high temperature central station service. (Optional supplementary requirements)																									
No. 8	W-TP304	EF	A	0.08	2.00	0.030	0.030	0.75 max.	8.0 to 11.0	18.0 to 20.0			75,000	30,000	35	Note 4	12,550	12,500	12,350	12,150	11,900	11,400	10,800	8,500	6,400	4,900
No. 8	W-TP316	EF	A	0.08	2.00	0.030	0.030	0.75 max.	11.0 to 14.0	16.0 to 18.0	2.0 to 3.0		75,000	30,000	35	Note 4	14,450	14,350	14,250	14,000	13,600	12,850	11,900	10,400	8,850	7,225
No. 8	W-TP321	EF	A	0.08	2.00	0.030	0.030	0.75 max.	9.0 to 13.0	17.0 to 20.0		0.4 to 0.6 Ti	75,000	30,000	35	Note 4	12,550	12,500	12,350	12,150	12,000	11,750	11,500	11,150	8,750	6,450
No. 8	W-TP347	EF	A	0.08	2.00	0.030	0.030	0.75 max.	9.0 to 13.0	17.0 to 20.0		0.8 to 1.0 Cb	75,000	30,000	35	Note 4	12,550	12,500	12,350	12,150	12,000	11,750	11,500	11,150	8,750	6,450
No. 8	S-TP304	EF	A	0.08	2.00	0.030	0.030	0.75 max.	8.0 to 11.0	18.0 to 20.0			75,000	30,000	35	Note 4	14,800	14,700	14,550	14,300	14,000	13,400	12,500	10,000	7,500	5,750
No. 8	S-TP316	EF	A	0.08	2.00	0.030	0.030	0.75 max.	11.0 to 14.0	16.0 to 18.0	2.0 to 3.0		75,000	30,000	35	Note 4	17,000	16,900	16,750	16,500	16,000	15,100	14,000	12,200	10,400	8,500
No. 8	S-TP321	EF	A	0.08	2.00	0.030	0.030	0.75 max.	9.0 to 13.0	17.0 to 20.0		0.4 to 0.6 Ti	75,000	30,000	35	Note 4	14,800	14,700	14,550	14,300	14,100	13,850	13,500	13,100	10,300	7,600
No. 8	S-TP347	EF	A	0.08	2.00	0.030	0.030	0.75 max.	9.0 to 13.0	17.0 to 20.0		0.8 to 1.0 Cb	75,000	30,000	35	Note 4	14,800	14,700	14,550	14,300	14,100	13,850	13,500	13,100	10,300	7,600

A155 Electric fusion welded steel pipe for high temperature service, usually 16 in. OD and larger, suitable for bending, flanging, corrugating and similar forming operations. (Optional supplementary requirements). (Note 3)

Class 1 heat treated and radiographed on longitudinal welded seam

No. 1	C45-FL	OH or EF	F	As agreed	0.80	Acid 0.05 Basic 0.04	0.05			CU optional 0.20 to 0.35		45,000	24,000	31	10,650	10,350	9,200	7,900	6,300				
No. 1	C50-FL	OH or EF	F	As agreed	0.80		0.05					50,000	27,000	29	11,900	11,500	10,450	8,900	6,900				
No. 1	C55-FL	OH or EF	F	As agreed	0.80		0.05					55,000	30,000	28	13,100	12,550	11,450	9,700	7,400				
No. 1	KC55-FL	OH or EF	F	0.20 to 0.35*	0.80	0.035	0.04	0.15 to 0.30				55,000	30,000	28	13,100	12,550	11,450	9,700	7,400				
No. 1	KC60-FL	OH or EF	F	0.24 to 0.35*	0.80	0.035	0.04	0.15 to 0.30				60,000	32,000	25	14,250	13,600	12,300	10,250	7,400				
No. 1	KC65-FL	OH or EF	F	0.28 to 0.33*	0.90	0.035	0.04	0.15 to 0.30				65,000	35,000	23	15,400	14,700	13,150	11,800	7,400				
No. 1	KC70-FL	OH or EF	F	0.31 to 0.35*	0.90	0.035	0.04	0.15 to 0.30				70,000	38,000	21	16,800	15,800	14,000	11,400	7,400				
No. 3	CM65-FB	OH or EF	F	0.18 to 0.25*	0.90	0.035	0.04	0.15 to 0.30		0.40 to 0.60		65,000	37,000	25	15,400	15,400	15,400	14,900	13,700	11,900			
No. 3	CM70-FB	OH or EF	F	0.20 to 0.27*	0.90	0.035	0.04	0.15 to 0.30		0.40 to 0.60		70,000	40,000	23	16,800	16,800	16,800	16,050	14,250	12,100			
No. 3	CM75-FB	OH or EF	F	0.23 to 0.28*	0.90	0.035	0.04	0.15 to 0.30		0.40 to 0.60		75,000	43,000	22	17,800	17,800	17,800	17,100	15,200	12,350			
No. 3	½CR-FB	OH or EF	F	0.21	0.80	0.035	0.04	0.15 to 0.30	0.50 to 0.75	0.45 to 0.65		65,000	40,000	24	15,400	15,400	15,400	14,900	13,700	11,900	9,500	5,900	
No. 4	1CR-FB	OH or EF	F	0.21	0.65	0.035	0.04	0.15 to 0.30	0.80 to 1.15	0.45 to 0.65		60,000	35,000	25	14,250	14,250	14,250	14,000	13,500	12,450	10,450	7,150	4,750	2,640
No. 4	1¼CR	OH or EF	F	0.15	0.30 to 0.60	0.030	0.03	0.50 to 1.00	1.00 to 1.50	0.45 to 0.66		60,000	30,000	20	14,250	14,250	14,250	14,250	13,700	12,450	10,450	7,400	5,250	3,800
No. 5	2¼CR	OH or EF	F	0.15	0.30 to 0.60	0.030	0.03	0.50 max.	1.90 to 2.60	0.87 to 1.13		60,000	30,000	20	14,250	14,250	14,250	14,250	13,700	12,450	10,450	7,400	5,500	3,960	2,850
No. 5	5CR	EF	F	0.15	0.30 to 0.60	0.040	0.03	0.50 max.	4.00 to 6.00	0.45 to 0.65		60,000	30,000	20	Note 4	12,700	12,500	12,150	11,800	10,900	9,500	6,950	4,950	3,140	2,090

Class 2 Not radiographed. All alloy steel pipe to be heat treated; also carbon steel pipe 3/4 in. and over in thickness

No. 1	C45-FL	OH or EF	F	As agreed	0.80	Acid 0.05 Basic 0.04	0.05			CU optional 0.20 to 0.35		45,000	24,000	31	10,100	9,800	8,700	7,500	5,950				
No. 1	C50-FL	OH or EF	F	As agreed	0.80		0.05					50,000	27,000	29	11,250	10,900	9,900	8,450	6,550				
No. 1	C55-FL	OH or EF	F	As agreed	0.80		0.05					55,000	30,000	28	12,400	11,900	10,850	9,200	7,000				
No. 1	KC55-FL	OH or EF	F	0.20 to 0.35*	0.80	0.04	0.05	0.15 to 0.30				55,000	30,000	28	12,400	11,900	10,850	9,200	7,000				
No. 1	KC60-FL	OH or EF	F	0.24 to 0.35*	0.80	0.04	0.05	0.15 to 0.30				60,000	32,000	25	13,500	12,900	11,650	9,700	7,000				
No. 1	KC65-FL	OH or EF	F	0.28 to 0.33*	0.90	0.04	0.05	0.15 to 0.30				65,000	35,000	23	14,600	13,950	12,450	10,250	7,000				
No. 1	KC70-FL	OH or EF	F	0.31 to 0.35*	0.90	0.04	0.05	0.15 to 0.30				70,000	38,000	21	15,750	14,950	13,250	10,800	7,000				
No. 3	CM65-FB	OH or EF	F	0.18 to 0.25*	0.90	0.04	0.05	0.15 to 0.30		0.40 to 0.60		65,000	37,000	25	14,600	14,600	14,600	14,100	12,950	11,250			
No. 3	CM70-FB	OH or EF	F	0.20 to 0.27*	0.90	0.04	0.05	0.15 to 0.30		0.40 to 0.60		70,000	40,000	23	15,750	15,750	15,750	15,200	13,500	11,450			
No. 3	CM75-FB	OH or EF	F	0.23 to 0.28*	0.90	0.04	0.05	0.15 to 0.30		0.40 to 0.60		75,000	43,000	22	16,850	16,850	16,850	16,200	14,300	11,700			
No. 3	½CR-FB	OH or EF	F	0.21	0.80	0.04	0.05	0.15 to 0.30	0.50 to 0.75	0.45 to 0.65		65,000	40,000	24	14,600	14,600	14,600	14,100	12,950	11,250	9,000	5,600	
No. 4	1CR-FB	OH or EF	F	0.21	0.65	0.04	0.05	0.15 to 0.30	0.80 to 1.15	0.45 to 0.65		60,000	35,000	25	13,500	13,500	13,500	13,250	12,750	11,800	9,900	6,750	4,500	2,500
No. 4	1¼CR	OH or EF	F	0.15	0.30 to 0.60	0.03	0.03	0.50 to 1.00	1.00 to 1.50	0.45 to 0.66		60,000	30,000	20	13,500	13,500	13,500	13,500	12,950	11,800	9,900	7,000	4,950	3,600	
No. 5	2¼CR	OH or EF	F	0.15	0.30 to 0.60	0.03	0.03	0.50 max.	1.90 to 2.60	0.87 to 1.13		60,000	30,000	20	13,500	13,500	13,500	13,500	12,950	11,800	9,900	7,000	5,200	3,750	2,700
No. 5	5CR	EF	F	0.15	0.30 to 0.60	0.04	0.03	0.50 max.	4.00 to 6.00	0.45 to 0.65		60,000	30,000	20	Note 4	12,050	11,800	11,500	11,150	10,350	9,000	6,570	4,690	2,970	1,980

Note * -- These are maximum values (not a range) depending on thickness of plate used.

A335 Seamless ferritic alloy steel pipe for high temperature service. (P identification symbols for type and grade). (Optional supplementary requirements)

A369 Ferritic alloy steel forged and bored pipe for high temperature service. (FP identification symbols for type and grade). (Optional supplementary requirements)

No. 3	P1 + FP1	(OH) or EF	F	0.10 to 0.20	0.30 to 0.80	0.045	0.045	0.10 to 0.50		0.44 to 0.65		55,000	30,000	30	13,750	13,750	13,750	13,450	13,150	12,500			
No. 3	P2 + FP2	(OH) or EF	F	0.10 to 0.20	0.30 to 0.61	0.045	0.045	0.10 to 0.30	0.50 to 0.81	0.44 to 0.65		55,000	30,000	30	13,750	13,750	13,750	13,450	13,150	12,500	10,000	6,250	
No. 4	P3b + FP3b	(OH) or EF	F	0.15 max.	0.30 to 0.60	0.030	0.030	0.50 max.	1.65 to 2.35	0.44 to 0.65		60,000	30,000	30	15,000	15,000	15,000	14,700	14,000	12,500	10,000	6,200	4,200	2,750	1,750
No. 5	P5 + FP5	(OH) or EF	F	0.15 max.	0.30 to 0.60	0.030	0.030	0.50 max.	4.00 to 6.00	0.44 to 0.65		60,000	30,000	30	Note 4	13,400	13,100	12,800	12,400	11,500	10,000	7,300	5,200	3,300	2,200
No. 5	P5b	(OH) or EF	F	0.15 max.	0.30 to 0.60	0.030	0.030	1.00 to 2.00	4.00 to 6.00	0.44 to 0.65		60,000	30,000	30	Note 4	13,400	13,100	12,800	12,400	10,900	9,000	5,500	3,500	2,500	1,800
No. 4	P11 + FP11	(OH) or EF	F	0.15 max.	0.30 to 0.60	0.030	0.030	0.50 to 1.00	1.00 to 1.50	0.44 to 0.65		60,000	30,000	30	15,000	15,000	15,000	15,000	14,400	13,100	11,000	7,800	5,500	4,000	
No. 4	P12 + FP12	(OH) or EF	F	0.15 max.	0.30 to 0.61	0.045	0.045	0.50 max.	0.80 to 1.25	0.44 to 0.65		60,000	30,000	30	15,000	15,000	15,000	14,750	14,200	13,100	11,000	7,500	5,000	2,800	
No. 5	P21 + FP21	(OH) or EF	F	0.15 max.	0.30 to 0.60	0.030	0.030	0.50 max.	2.65 to 3.35	0.80 to 1.06		60,000	30,000	30	15,000	14,800	14,500	13,900	13,200	12,000	9,000	7,000	5,500	4,000	2,700
No. 5	P22 + FP22	(OH) or EF	F	0.15 max.	0.30 to 0.60	0.030	0.030	0.50 max.	1.90 to 2.60	0.87 to 1.13		60,000	30,000	30	15,000	15,000	15,000	15,000	14,400	13,100	11,000	7,800	5,800	4,200	3,000

Carbon Steel Pipe for High Pressure, High Temperature Service

The outstanding carbon steel specification for high pressure and/or high temperature service is ASTM A106. This specification is restricted to seamless pipe suitable for bending, flanging, and similar forming operations, and for fusion welding. Grade A rather than Grade B should be used for close coiling, cold bending, or for forge welding. The purpose for which the pipe is to be used should be stated in the order. While A106 pipe is suitable for moderate superheated steam temperatures, the principal demand for this product in modern central stations is for the boilerfeed lines, which usually operate at temperatures below 500 F. It is also used extensively for extracted steam lines, high pressure saturated steam piping, lubricating oil lines for turbines, and similar purposes where a thoroughly dependable product is required.

Specification A106 has rather complete chemical requirements, abstracted in Table 1, as well as physical properties determined by tensile, bending, and flattening tests. More test specimens are usually required than is the case with specification A53. There are requirements for finish that describe surface defects and define when they can be corrected by machining or grinding and when they constitute a basis for rejection.

There also are supplementary requirements of an optional nature which may be specified in ordering pipe 8 in. and over in nominal diameter. These provide for a check analysis on each length, if desired, and for a transverse tension test, a flattening test, and an etch test on both ends of each length. These tests are expensive, but they are much more searching than the usual routine tests and do much to insure finding and eliminating any defective length or lengths. Sometimes a compromise is made by testing specimens from one end only of each length.

The need for testing individual lengths of pipe intended for severe service conditions became apparent several years ago when it was found that pipe containing laminations sometimes passed unnoticed if only one or two lengths from each lot were tested. As a result of this experience, and in order to satisfy the exacting needs of the power industry, supplementary requirements of an optional nature that could be specified if and as required were then added to A106 and included in the alloy steel pipe specifications when they appeared later. These tests have proved to be a most effective means for detecting and eliminating faulty lengths of pipe, and the added expense is amply justified for high pressure piping. Ultrasonic examination of each length is sometimes made, particularly with alloy steel pipe, but this has to be by special agreement, and suspicious indications may not be accepted as grounds for rejection at the expense of the pipe mill.

Low Alloy Ferritic Steel Power Piping

Some 20 years ago when superheated steam temperatures first approached a point where the use of alloy steel pipe seemed called for from a strength standpoint, interest centered for several years on what is known as "carbon-moly," which contains about ½ percent molybdenum. This continued until the failure in 1943 of a welded joint in the 12 in. carbon-moly main steam line of a power company after some 5 years' operation at an average temperature of 935 F, with swings to higher temperatures.

Investigation disclosed the advantages of chromium as a graphitization inhibitor, and the trend then turned to chromium-molybdenum steels for steam temperatures of 900 to 1050 F, with the percentage of these alloying elements varied to suit the operating temperature. The presence of chromium in a steel helps to keep the carbon in combined form as chromium — or more complex — carbides, thus tending to prevent the release of free carbon to form graphite with prolonged exposure to elevated temperature.

Molybdenum is valuable for its strength giving properties at elevated temperatures, whereas chromium inhibits graphitization and tends to reduce corrosion tendencies. The following compositions of low alloy ferritic steels are presently favored for the indicated temperature ranges above the 775 to 800 F ceiling established for plain carbon steel:

Nominal composition, percent	Usual temperature range, F
½ Mo or ½ Cr, ½ Mo	750 to 850
½ Cr, ½ Mo	850 to 950
1 Cr, ½ Mo	950 to 1000
1¼ Cr, ½ Mo, ½ Si	950 to 1050
2¼ Cr, 1 Mo	1000 to 1075

For steam temperatures much above 1050 F, chromium-nickel austenitic stainless steels are used because of their higher strength in this temperature range and for their superior resistance to corrosion. Another possibility for 1000 to 1100 F in the low alloy ferritic class is a 1 percent chromium, 1 percent molybdenum steel containing about ¼ percent vanadium. The latter, however, is an age hardening steel where superior high temperature strength is imparted by special heat treatment. It has not yet been accorded code status as pipe.

The chromium-molybdenum low alloy ferritic steels are generally preferred to stainless steels for steam temperatures up to 1050 F for two reasons: (1) they are less expensive; and (2) they are easier to weld without subsequent cracking. Where corrosion is a prime consideration, more chromium or chromium and nickel may be called for, as discussed on the next page under "Corrosion Resistant Steels."

Corrosion Resistant Steels

Where corrosion is an important consideration, it is sometimes necessary to use the more expensive steels containing considerable amounts of chromium, or chromium in conjunction with nickel or other alloying elements added for various reasons. It is of interest to note, however, that steam at temperatures up to 1100 F is not ordinarily found to be a corrosive medium. The 4 to 6 percent chrome steel is the least expensive of those usually considered as really being corrosion resisting steels, beyond which there are other classes of ferritic steels in 7 to 9 percent and the 12 to 15 percent chromium ranges, and finally the 18 percent chromium-8 percent nickel and richer alloys among the austenitic steels.

The austenitic chrome-nickel steels have not been used much for power piping, owing to their cost and to the fact that other steels have usually served the purpose so far. Ferritic alloy steels containing considerable amounts of chromium, with or without other alloying elements, have been used extensively in the oil industry and in the high temperature end of steam superheater circuits, so that their properties are fairly well established. Intermediate and high alloy ferritic steels are definitely difficult to weld, having air hardening tendencies that need to be counteracted by refinements in preheating and postheating technique and by other niceties of welding procedure carried out under careful control. The 4 to 6 percent chrome steels in particular have pronounced air hardening tendencies that require special care in fabrication. Austenitic steels, on the other hand, do not air harden but are softened by quenching in air or water. Hence, strong, tough, and ductile welds can be obtained in the austenitic steels without preheating or postheating, although welding procedures differ in these respects.

Welding of straight chromium ferritic steels is facilitated to some extent by the presence in the steel of certain elements such as columbium or titanium, added in amounts having a definite ratio to the carbon content. The columbium or titanium tends to stabilize the carbon in the form of columbium or titanium carbides, thus reducing the air hardening tendencies normally associated with the straight chromium ferritic steels.

Austenitic Steels; Changes in ASTM Designations for Alloy Steel Pipe

In welding chrome-nickel austenitic steels where air hardening is not a factor, the columbium or titanium acts solely as a stabilizer for holding the carbon in solution in the heat affected area adjacent to the weld. With service temperatures in the range of 800 to 1500 F, and particularly in the vicinity of 1200 F, the carbon in the iron carbide of chrome-nickel austenitic steels has a pronounced tendency to come out of solution and unite with some of the chromium to form chromium carbides. This action is most pronounced along the grain boundaries where the attendant removal of chromium from solution in the ferrite tends to impair its corrosion resisting properties to an extent which permits the steel to become embrittled. The stabilizing elements serve to prevent the formation of chromium carbide by uniting, preferentially, with the precipitated carbon to form other carbides, thus leaving intact for resisting corrosion the chromium content already in solution in the steel.

While columbium and titanium are beneficial as stabilizers, their presence has been found to promote cracking in wholly austenitic weld structures. For this reason it is customary to weld Types 321 and 347 stainless steel pipe with electrodes that deposit metal containing a small amount — usually 5 to 15 percent — of free ferrite in the austenitic matrix as a means of suppressing this cracking tendency. The desired balance between the austenite and ferrite phases present in the deposited metal can be obtained by adjusting the percentages of the several alloying elements present in the electrode. Too much ferrite should be avoided, however, in order to prevent some of it from going over into the brittle sigma phase with prolonged exposure to high temperature in service.

The TP304 austenitic steel without columbium or titanium — see Specifications A213, A312, A358, and A376 in Table 1 — has high temperature strength equivalent to the TP321 and TP347 stabilized austenitic steels except that from 200 F through 1050 F the S-values shown exceed 62½ percent, but not 90 percent, of the yield strength at temperature. According to a footnote accompanying the Boiler Code's Table P-7, the S-values shown in Table 1 from 200 F through 1050 F "may be used where slightly greater deformation is permissible." For use where such is not the case, the Boiler Code provides a second set of lower S-values. Since TP304 steel is not stabilized, it is subject to carbide precipitation with prolonged exposure to temperatures above 800 F.

The original ASTM specification for seamless alloy steel pipe was A158, which appeared as tentative from 1934 to 1936, when it was adopted as standard. Subsequently, it alternated between standard and tentative until it was eventually superseded by A312, A335, and A376 and withdrawn completely by 1953. Initially, A158 contained many of the ferritic grades of steel now listed in A335, and several of the austenitic grades now listed in A312, A358, and A376 — see Table 1. During the intervening years, as one steel or another pre-

dominated in popularity, several ferritic compositions appeared in separate individual specifications which eventually were merged into A335 and disappeared as individual specifications. The identification of grades of steel with their old and new specification numbers shown in Table 2 may be found useful in making comparisons.

TABLE 2—CURRENT SPECIFICATION NUMBERS are identified here with obsolete specification numbers for the respective alloy steel compositions shown

Nominal composition, percent	Former A158 designation	Former individual specification	Current specification designation
C, ½ Mo	P1	A206	A335 P1
½ Cr, ½ Mo	—	A280	A335 P2
1 Cr, ½ Mo	—	A315	A335 P12
1 ¼ Cr, ½ Mo, ½ Si	P11	—	A335 P11
2 Cr, ½ Mo	P3b	—	A335 P3b
2 ¼ Cr, 1 Mo	—	A213 T22	A335 P22
5 Cr, ½ Mo, 1 ½ Si	P5b	—	A335 P5b
18 Cr, 8 Ni	P8a	—	A376 TP304
18 Cr, 8 Ni + Ti	P8b	—	A376 TP321
18 Cr, 8 Ni + Cb	P8d	—	A376 TP347

2. Power Piping Procurement Problems Complicated

The manufacture and stocking of pipe for high pressure and/or high temperature power generation is complicated by several factors, among which are: (a) the need for heavy walls; (b) the use of a variety of carbon and alloy steel materials peculiar to this industry; and (c) the relatively small amounts of any item required on a given job. Several choices of pipe are available.

The term "seamless" is commonly used in piping trade vernacular to denote pipe made from solid billets that are pierced and rolled into pipe on a Mannesmann or Pilger mill. Before these processes were developed, "seamless" pipe was made from circular plates in a hydraulic press by pushing the plates through successively smaller dies with a round-nose ram, eventually cutting off the closed end. This process, known as cupping and drawing, is still used to some extent. The product is often referred to as "cupped and drawn" pipe to distinguish it from the Mannesman and Pilger varieties of "seamless" pipe. These processes, together with various methods for making welded seam pipe, are described in "Piping Handbook," by the author of this article, 4th edition, pages 348-354, published by McGraw-Hill Book Co., Inc.

More recently other kinds of pipe have been produced without welded seams, the two principal varieties being "forged, turned, and bored" pipe and "hollow forged" pipe. Trade usage is to call them by these names to distinguish them from other varieties of seamless. Forged, turned, and bored pipe is made by a process similar to that used for naval gun barrels, by forging billets to the approximate outside diameter and length of pipe desired, following which the forgings are turned on the outside and bored on the inside to the desired dimensions.

Hollow forged pipe is made by piercing round billets in a hydraulic press by extrusion methods, following which the pierced — or "hollow forged" — billets are extruded through a die and over a mandrel in another hydraulic press in the form of pipe. One of the distinctive features of this process is the use of glass instead of carbonaceous material for lubrication between the work and the die and mandrel. Glass, which is molten at forging temperature, serves to prevent metal to metal seizure and is claimed to give a somewhat smoother surface condition than is obtained by piercing and rolling in a Mannesmann or Pilger mill. A good description of this extrusion process will be found in "Mechanical Engineering," September 1952, pages 748 and 749.

Mannesmann or Pilger mills available in the United States for piercing and rolling seamless pipe in light to medium wall for other commercial purposes are inadequate for producing anything heavier than Schedule 160 and, in fact, do not keep all the dies and mandrels needed for producing a full line of Schedule 160 or even a full line of some of the lighter schedules. So far, American seamless mill people have declined to spend the money needed for installing the piercing and rolling equipment required for producing pipe in a full line of sizes, in weights up to and including Schedule 160, on the grounds that the volume of business would not warrant the expense. One pipe mill, however, offers "cupped and drawn" pipe made by the original seamless method in a considerable variety of diameters and wall thicknesses. This process has shortcomings, in that available lengths are short and the surface finish, particularly with alloy steel materials, is not as smooth as with other methods. Hence the fabricators and users of large diameter and/or heavy wall pipe have had to turn to other sources.

Central station main steam pipe beyond the range of present American seamless mills is presently available as forged, turned, and bored pipe resembling naval gun barrels — ASTM Specification A369 — or as a "hollow forged" pipe made by pushing a pierced ingot through an extrusion press. Hollow forged pipe is furnished to a number of "seamless" specifications, including — see Table 1 — A106, A312, A335 and A376. Both of these varieties of pipe are offered in lots of lesser footage or tonnage than is usually required for a rolling of "seamless" pipe. Seamless pipe heavier than Schedule 160 can also be obtained from Europe and Japan, whose mills are capable of turning out large diameter pipe with heavier walls than are presently available from American seamless mills.

In choosing between these sources, consideration has to be given to cost and variable lengths, both of which vary considerably between processes. In such evaluations, shorter lengths should be charged with the cost of

the extra tests and extra welds incidental to their use.

"Hot" and "cold" reheat piping is another field where "seamless" pipe often is not available in large diameters of the medium weight schedules because the seamless mills feel that sufficient volume of business does not exist to warrant producing these items. Reheat piping usually comes in the size range of 16 to 24 in. OD, with wall thicknesses ranging from Schedule 40 to Schedule 120, depending on crossover pressure and temperature. Carbon steel is used for "cold" reheat lines and some variety of chromium-molybdenum for "hot" reheat. In sizes where "seamless" pipe is not available, the choice often develops on "hollow forged" pipe or on ASTM Specification A155, which is made from plates with an electric fusion welded seam that is usually radiographed.

Another special procurement problem exists in buying seamless carbon steel pipe in nominal sizes up to and including 1½ in. where, for commercial pricing reasons, the pipe mills insist on furnishing to tubing specifications such as A83, A179, A192, or A210 instead of to pipe specifications such as A53 or A106.

3. Welding Procedures Have Been Revised and Expanded

Welding procedures for the shop fabrication or field erection of piping systems have been formulated over the past 25 years by the ASME Boiler and Pressure Vessel Committee and ASA Sectional Committee B31 on Code for Pressure Piping in conjunction with the American Welding Society and other organizations. As would be expected, experience has pointed the need for many changes. Hence, welding procedures have been progressively revised and expanded from time to time to embody the latest thinking on the subject.

Although procedures have been more explicitly described in certain respects to avoid doubt as to what constitutes safe practice, unnecessarily burdensome and expensive requirements have at the same time been relaxed where experience so justifies. As a matter of policy it is the intention of the Boiler Code and Piping Code committees to have identical welding requirements in both codes for similar classes of power piping. Actually, there is a certain amount of time lag which sometimes precludes maintaining full agreement. At the present time, the latest requirements are contained in a recently issued edition of the American Standard Code for Pressure Piping designated ASA B31.1-1955. A digest of some of the principal features follows.

The code requires that welding procedures, welders—meaning welding equipment—and welding operators shall be qualified according to tests prescribed in Section 6 of Fabrication Details. Shop fabrication and field erection of power piping systems have to be carried out by qualified welding operators using procedures and welding equipment that have been qualified for the respective base materials and filler metals. In other words, actual work has to be carried out by qualified operators using qualified equipment under the same procedures for which the welding process was qualified for the respective base materials and filler metals.

Base materials are identified by a series of P-numbers—see Tables 1 and 3—and filler metals by a series of F-numbers that tie in with a series of A-numbers denoting analysis of deposited weld metal. Electrode and welding rod classification numbers are associated in the Code with F-numbers in the F-number table so as to insure obtaining satisfactory usability characteristics in depositing filler metal having the respective properties. Practically all electrodes for welding carbon steel and low alloy steel pipe have essentially the same composition core wire of low carbon steel, but with coatings that differ from one classification to another in order to provide the variations needed in mechanical properties, operating characteristics, and chemical composition of deposited metal.

The three series of welding Numbers—P, F, and A—are correlated through tables in the Code in such a manner as to insure obtaining the following cardinal results:

1) Strength of filler metal commensurate with base material.

2) Chemical composition of filler metal compatible with base material.

3) Satisfactory operating characteristics of electrode or welding rod for the particular application.

Requalification Required

Comprehensive requirements are included to cover the several contingencies that might arise due to changing one or more of the basic conditions under which a welding process or operator was originally qualified. Generally speaking, requalification is required if there is a change from:

1) One welding process to another.

2) One P-number composition to another. Joints involving two base materials of different P-numbers have to be specifically qualified even where qualification tests on each material welded to itself have previously been made.

3) One filler metal analysis or type to another. (See Code for specific particulars.)

4) One nominal composition or type of flux to another in submerged arc welding.

5) Welding positions already qualified to a different position.

6) One heat treating temperature and time cycle range to another.

7) Using a backing ring to not using a backing with metal arc welding, or vice versa with gas welding.

8) Multiple pass per side to single pass per side in automatic or semiautomatic welding.

9) Single arc to multiple arc in automatic or semiautomatic welding.

TABLE 3—PREHEATING AND STRESS RELIEVING REQUIREMENTS for different P-number pipe materials summarized here are based on the Code for Pressure Piping ASA B31.1-1955 and on recommended practices of the American Welding Society

P-Number 1: Carbon steels 40,000 to 75,000 psi minimum tensile requirements

Pipe Specifications Applicable: A53, A83, A106, A120, A134, A135, A139, A155, A179, A192, A210

Preheating: Not mandatory, but is recommended under the following conditions: Under field conditions or otherwise where the ambient temperature is less than 32 F, local preheating to a hand-hot condition is recommended. It is further recommended that no welding be done when surfaces are wet or covered with ice; when snow is falling on the surfaces to be welded; nor during periods of high wind, unless the welders and the work are properly protected. Experience has indicated that pre-heating to 250 F is advisable during actual welding operations regardless of ambient temperature, when welding carbon steel having a tensile strength of 70,000 psi or higher. (Note 1 for discussion of similar problems with low alloy steels)

Stress Relieving: Mandatory when the pipe wall thickness is ¾ in. or greater. In unreinforced and reinforced branch connections, the thickness of the run shall govern. When flanges are attached by fillet welds, the thickness of the pipe shall govern. Stress relieving shall be performed at a temperature of 1100 F or over for carbon steels. (Note 2)

P-Number 3: Low alloy steels with a chromium content not exceeding ¾ percent and/or a total alloy content not exceeding 2 percent

Pipe Specifications Applicable: A155, A335 and A369 in Grades P1 and P2 or equivalent compositions.

Preheating: Mandatory to 300 F minimum during actual welding operations, AWS advises that preheating may be interrupted after deposited metal equals one-third of wall thickness, or a minimum of two layers. (Note 1)

Stress Relieving: Welds in carbon-molybdenum steel shall be stress relieved when the wall thickness is ½ in. or more. Mandatory for any thickness of all other P-Number 3 materials. Stress relieving shall be performed at a temperature of 1200 F or over. (Note 2)

P-Number 4: Low alloy steels with a chromium content between ¾ percent and 2 percent and/or a total alloy content not exceeding 2¾ percent

Pipe Specifications Applicable: A155, A335 and A369 in Grades P3b, P11 and P12 or equivalent compositions.

Preheating: Mandatory to 375 F minimum during actual welding operations. AWS advises that preheating may be interrupted after deposited metal equals one-third of wall thickness, or a minimum of two layers. (Note 1).

Stress Relieving: Mandatory for any thickness of P-number 4 materials, at a temperature of 1200 F or over. (Note 2)

P-Number 5: Ferritic alloy steels with a total alloy content not exceeding 10 percent

Pipe Specifications Applicable: A155, A335 and A369 in Grades P5, P5b, P21 and P22 or equivalent compositions.

Preheating: Mandatory to 450 F minimum. AWS advises that these grades be completely welded and postweld heat treated before interruption or, alternatively that the weld joint be given a short time draw treatment at 1200-1300 F before interruption of the cycle. Except that where the wall thickness is 1 in. or less, preheating may be interrupted as for P-numbers 3 and 4. (Note 1)

Stress Relieving: Mandatory for any thickness of P-number 5 materials at a temperature of 1200 F or more. (Note 2)

P-Number 8: Austenitic stainless steels

Pipe Specifications Applicable: A213, A312, A358, A376 in Grades TP-304, TP-316, TP-321 and TP-347.

Preheating: Optional. (Note 3)

Stress Relieving: Optional. (Notes 3 and 4)

Note 1—See AWS Recommended Practice D10.3-55T, "Interruption of Heat Treatment Cycles for Low Chromium-Molybdenum Steel Piping Materials."

Note 2—The exact temperature range shall be established in the procedure specification. Parts shall be held at temperature for at least 1 hr per in. of wall thickness, but in no case for less than ½ hour.

Note 3—See AWS Recommended Practice D10.4-55T, "The Welding of Austenitic Chromium-Nickel Steel Piping and Tubing."

Note 4—See AWS Recommended Practice D10.1-55T, "Postweld Heat Treatment of Austenitic Weldments."

10) One type of inert gas to another with inert gas arc welding.

11) Consumable to nonconsumable electrode process with inert gas arc welding, or vice versa.

12) One nonconsumable electrode to another with inert gas arc welding, such as a carbon electrode to a tungsten electrode.

Preheat, Stress Relief

The need for preheating depends on wall thickness and on the air hardening characteristics of the particular base material and filler metal in cooling from welding heat. The chromium-molybdenum pipe steels are generally classed as "air hardening" in the sense that they will harden in the heat affected zone after welding followed by air cooling. Whether or not this results in cracking depends on composition and on welding procedures including preheating and stress relieving. Among the questions to be settled in setting up procedures for each combination are:

Preheating:

1) What minimum temperature shall be maintained while filler metal is being deposited?

2) Can preheating be interrupted after a weld is partially completed and the weld allowed to cool to ambient temperature, or must preheat be maintained continuously until the weld is completed and stress relieved?

Stress Relieving:

1) What wall thickness and materials require stress relief?

2) What temperature range shall be used?

3) How long shall the joint be held at temperature?

4) How fast shall the joint be allowed to cool after stress relief?

Piping Code requirements and AWS recommended practices on preheating and stress relieving for the pipe steels considered herein are summarized in Table 3.

The following abstract of explanatory text from AWS Recommended Practices D10.3-55T summarizes the bases of their recommendations concerning "Interruption of Heat Treatment Cycles for Low Chromium Molybdenum Steel Piping Materials."

The effects of interrupting the welding-postweld heating cycle are both metallurgical and mechanical in nature. Metallurgical effects involve microstructural changes attendant on cooling to ambient temperature. Mechanical effects involve thermal contraction of the weldment and possibly localized distortion. The consequences of these effects must be considered concurrently in deciding whether to permit interrupting the heating cycle.

The heat cycle which gives the greatest assurance of freedom from cracking in the chromium-molybdenum low alloy steels is one in which there is no interruption of preheating during welding, and an immediate postweld heat treatment is applied. However, there are operational and economic reasons for interrupting the welding-postweld heating cycle that make interrupting the process almost mandatory in some cases. Hence present practice is, where practicable, to permit interruption after the weld has been built up to 1/3 of the wall thickness, or a minimum of two layers, provided that cooling to ambient temperature is slow and uniform around the joint, usually accomplished under an asbestos blanket. Preheat temperature is, of course, restored before

welding is resumed. An increased cooling rate means greater hardening for a given material, and harder structures are less ductile. Also, a faster cooling rate will tend to entrap more gases, including hydrogen, in the solidified metal, which promotes underbead cracking.

In deciding whether to permit interruptions in the heat cycle with any of the chromium-molybdenum pipe materials, several factors which should be considered are: ambient temperature; mass of base metal; joint restraint and support of piping during fabrication; and effects of moisture and other hydrogen forming constituents.

As the temperature of ferritic steels decreases, their capacity for plastic deformation also decreases and fracture can be produced at notches by a lower level of applied energy. Further, as the temperature is lowered, contraction takes place which increases the stress level within the weld area, especially if the weldment is restrained externally. Thus, as the ambient temperature is lowered, it becomes better practice not to interrupt the heating cycle. This factor is particularly important in cold winter weather and at unsheltered construction sites.

An increase in mass of the base material increases both the restraint on the weld metal and the cooling rate from welding temperature of both heat affected base material and weld metal. In thicker materials, the weld is subjected to higher stresses than it is in thinner sections because the thicker base material yields less to the contracting forces of weld metal during cooling and the stress level in the weld metal is therefore higher. Hence the distinctions shown in Table 3 where wall thickness is involved.

Where there is considerable residual stress in a weld between restrained members, as in the closure joint of a pipe line with cold spring, interruption of preheat is less advisable. Likewise if a weldment is to be moved prior to completion of the heat cycle, or if it is inadequately supported against bending, the weld might be subjected to bending stresses that could cause cracking. Under these circumstances and especially with P22 and 5 percent chromium materials, an intermediate heat treatment is advisable.

Water vapor is detrimental in proximity to welding because of the formation of atomic hydrogen, which may be absorbed in the weld metal. Upon solidification and cooling of the weld metal, molecular hydrogen is formed, causing high stresses and often cracking. Under conditions of high humidity, electrodes should be kept dry and warm up to the time of use, particularly if interruptions in the heat cycle will be allowed. Hydrogen also can be introduced from constituents in the electrode coating, so that the use of low-hydrogen coatings is advisable where interruptions are contemplated.

The degree of control that is exercised in the fabrication of the piping system is an important consideration in deciding how liberal a procedure can be used. A fabricator having adequate facilities, supervision, and control of welding procedures can safely adopt practices which would be unsatisfactory with a less experienced or less responsible fabricator of piping.

The conditions of field erection of piping systems may be such that the degree of control over welding procedures and the quality of inspection given the work is not equal to that which obtains in shop fabrication. Under such conditions, a more conservative procedure should be used for field welding than would be required for shop fabrication.

Preheating or stress relieving of the austenitic stainless steels listed under P-Number 8 is optional and not a requirement of the Code but may be a matter of agreement between the purchaser and the fabricator. If preheating and stress relieving are agreed upon, they should be compatible with the analysis of both the base material and the weld metal and should be determined as most suitable for the particular service application. This subject is discussed in detail in AWS Recommended Practices D10.4-55T entitled "The Welding of Austenitic Chromium-Nickel Steel Piping and Tubing" and D10.1-53T "Postweld Heat Treatment of Austenitic Weldments."

In joining dissimilar ferritic materials, if either material requires preheating or stress relieving, the joint shall be so treated. In welds between austenitic and ferritic materials, preheating and stress relieving or other postweld heat treatment are optional and shall be a matter of agreement between the contractor and purchaser.

While this is a rather complete summary of these phases of welding as presently intended in both the Boiler and Piping Codes, including recommended practices of the American Welding Society, it is suggested that the latest issues of the respective codes be referred to for carrying on actual work under their jurisdiction.

Explanatory Notes, Abbreviations, and Symbols for Table 1, pp. 98, 99

Note 1 — Physical properties in parenthesis are expected minimums although not required by the specifications.

Note 2 — The several types and grades of pipe tabulated should not be used at temperatures in excess of those for which S-values are indicated. Allowable stresses for intermediate temperatures may be obtained by interpolation. Where welded construction is used, consideration should be given to the possibility of graphite formation in the following steels: carbon steel above 775 F; carbon-molybdenum steel above 875 F; chromium-molybdenum steel above 975 F unless the chromium content exceeds 0.60 percent.

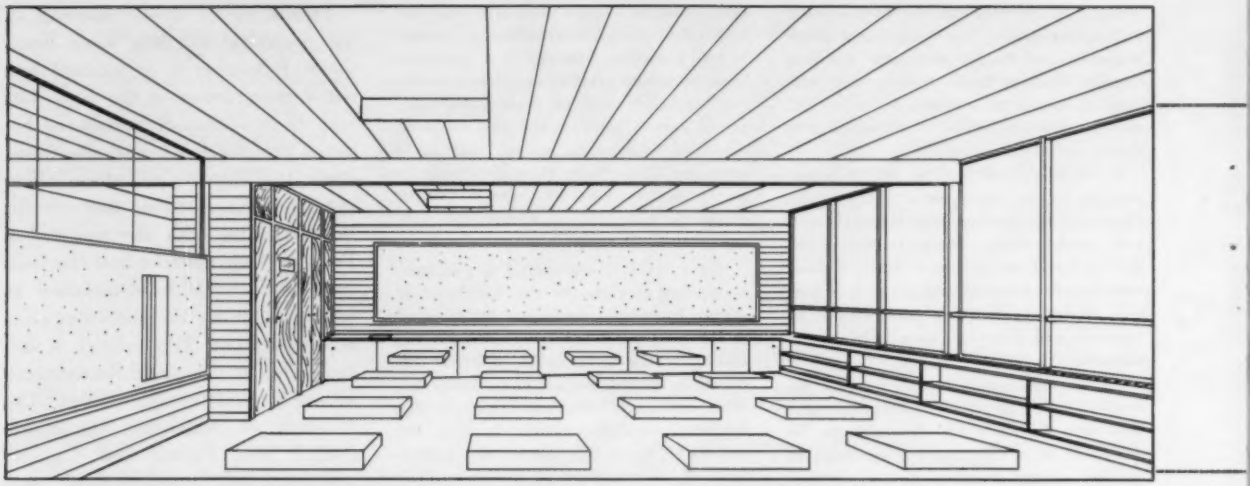
Note 3 — Pipe conforming to ASTM Specification A134, A139, A155 and A358 is not included in Boiler Code lists for materials or allowable stresses.

Note 4 — Values from —20 F to 650 F vary with temperature; see Boiler Code or Piping Code.

Type and grade of pipe
BW — Butt welded seam (sizes up to 4 in.).
ERW — Electric resistance welded seam (sizes up to 30 in.).
Gr — Grade.
LW — Lap welded seam (sizes 2 in. to 24 in.).
S — Seamless (sizes up to 24 in.).
W — Automatic electric welded seam.
C — Carbon steel.
KC — Killed carbon steel.
CM — Carbon-molybdenum steel.
CR — Chromium-molybdenum steel.
FB — Firebox quality steel. } Either may be used as specified.
FL — Flange quality steel. } Usual commercial practice shown.
Pl etc — Identification symbol for seamless, composition 1 etc.
FPl etc — Identification symbol for forged and bored composition 1 etc.

Steel Melting Process
AB — Acid bessemer.
DAB — Deoxidized acid bessemer.
EF — Electric furnace.
OH — Open hearth.
(OH) — Open hearth permissible for A335 seamless pipe and permissible on agreement for A369 forged and bored pipe.

Predominant Structural Phase of Steel
A — Austenitic.
F — Ferritic.



TYPICAL CLASSROOM in new elementary school has window wall extending the length of the room. Air for heating and ventilation is introduced through an uninterrupted ⅝ in. slot in the stool from one end of the window to the other

Continuous Slot Air Delivery Under Large Windows Prevents Drafts

. . . in new school under construction

By K. L. Beseke
Holland and Beseke
Consulting Engineers

and

L. J. Schutte
Lindl-Schutte & Associates
Architects and Engineers

A NEW and somewhat different heating and ventilating system is being incorporated in the new Wildwood elementary school, now under construction, in West Allis, Wis. Chief feature of the system is the method of air delivery via continuous slots under the windows. This was thoroughly pretested in a laboratory mock-up of one of the new classrooms to study air flow and temperature control patterns. Results indicate that this new method answers the need for greater comfort in school rooms with large window areas.

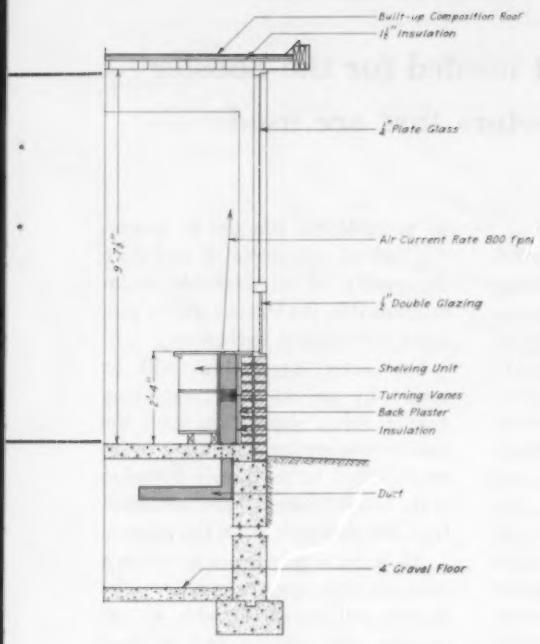
In schools with other systems, uncomfortable cold convection currents near large windows are sometimes experienced with outside temperatures close to zero F. And during mild weather, uncomfortable drafty conditions may be experienced when cool air is introduced through ventilating systems to prevent overheating.

The most logical answer seemed to be the introduction of the air at the bottom of these large window areas through long narrow slots extending the lengths of the windows.

To arrive at the most practical method of doing this, considerable experimentation was necessary to determine the ideal velocity and air distribution within the room.

Answers were sought to the following questions:

1) Which is better, a slot diffuser or a perforated metal one?



A PLENUM CHAMBER, behind the steel cabinet bookshelves, and below the window, is provided to obtain a uniform air velocity throughout the length of the continuous slot. A booster coil is in the vertical branch of the supply duct

2) What discharge velocity is necessary to cause the air to travel across the room?

3) What air stream deflection will produce the desired results?

4) Where should the return air intake be located—in or over the door?

5) What is the warm-up time of the room, particularly the area near the floor adjacent to the window sill cabinet?

6) What effect has the sky light on the air distribution pattern?

Classroom Mock-up Studied

The outside window of the mock-up classroom was made of sheet metal to simulate the large glass area extending the length of the room. This sheet metal panel was cooled and heated to simulate various weather conditions.

The long, narrow slot for admitting air extended the entire length of the classroom below the simulated window and had an effective width of only ⅝ in. The slot was installed about 12 in. from the inside surface of the window.

Several deflections in the diffuser were tried, as were different return air intake locations. The minimum acceptable air velocity at the diffuser was found to be 750 fpm for the particular ceiling height and classroom width. To provide some margin of safety, a face velocity of 800 fpm was determined as the minimum. Naturally, the vertical distance from the diffuser to the ceiling, plus the width of the classroom, affects the velocity at the diffuser.

The tests also indicated that a slot width of ⅝ in. provided the desired air circulating pattern in the room when the design cfm was circulated.

It was also found extremely important for the air to be deflected toward the window to prevent cold downdrafts from breaking through the air admitted through the diffuser. It was also found important to change the angle of deflection as the diffuser was moved nearer to the window. Thus, the air was forced to "scrub" the inside surface of the window. Proper air distribution was not hindered, providing the deflection was properly changed.

The location of the return air intake was found to have no appreciable effect upon the results.

No evidence of stratification was present. In fact, the temperatures in the entire room did not vary more than 1 F, and the highest temperatures were recorded near the floor, which indicates a constant motion of air throughout the room. Within the occupied area of the classroom under all conditions, no air velocity was measured above 55 fpm as a maximum. Also, no velocity below 15 fpm was measured. This was true with supply air temperatures as low as 48 F.

The importance of the continuous supply outlet cannot be over-emphasized. Tests showed that cold air dropping off the simulated window spilled over to the floor if the supply outlet was not continuous, and that the occupant seated adjacent to the

Photograph courtesy Barber-Colman Co.

LABORATORY MOCK-UP TESTS showed that cold air dropping off the cooled simulated window spilled over to the floor which would make adjacent occupants uncomfortable if the supply outlet was not continuous

. . . air vents and drain valves are not needed for the booster coils but are provided for the few convectors that are used

area where no air was being supplied would be extremely uncomfortable.

Plenum Specially Designed

To obtain uniform air distribution along the entire length of the slot outlet, a special cabinet which serves the dual purpose of a plenum chamber and bookshelving was designed.

From the main supply duct around the perimeter of the building, a vertical branch duct at the center of each classroom delivers the air into the bottom of the plenum chamber.

Upon entering the plenum chamber, the air is turned both ways by turning vanes. Traveling horizontally along the bottom of the plenum, the air is deflected upward by additional, carefully spaced, turning vanes that protrude into the air path at an angle of 15 deg. This air is then discharged upward against small perforated metal plates to obtain almost perfect pressure equalization throughout the length of the plenum, resulting in a uniform outlet velocity along the entire length of the slot outlet.

The air is heated by hot water booster coils. One coil is in the supply branch duct for each classroom. Electrostatic filters are also being installed for each classroom wing. All piping and ducts are in the crawl space. This has two advantages. Once the floors are constructed, the installation of heating and ventilation and other mechanical services can proceed without interruption. Also, the heat lost from the hot water pipes and ducts will add to the assurance that classroom floors will be warm. All air that is exhausted — except from toilets and kitchens — will be discharged into the crawl space, which is vented through louvers with backdraft dampers, to maintain higher floor temperatures.

System Is Two Pipe Hot Water

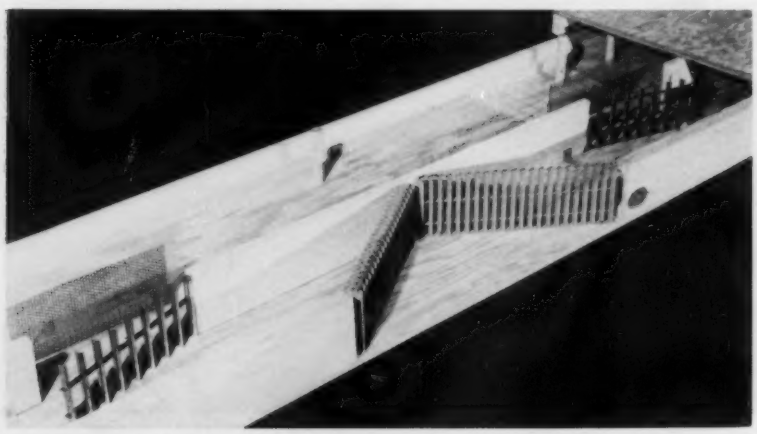
The system is basically arranged as a two-pipe reversed return hot water system. Hot water will be generated with two oil fired package type hot water boilers, each with a capacity of 2,748,000 Btu per hr output. The fuel oil will be No. 5, and since the quality of oil available is indeterminable, the burners will be provided with electric preheaters.

The water temperature will be varied by an automatic three-way mixing valve, depending upon the outside temperature. Throttling valves are installed in the supply branches to the booster coils and are modulated from the electronic room thermostats.

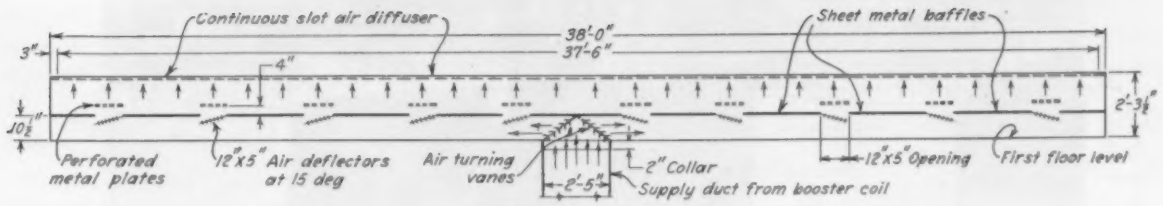
All of the supply mains maintain a constant pitch upward away from the boilers and terminate with an expansion tank on the end of each main. The supply mains are above the booster coils, and the return mains are below. With this arrangement, all the air can be vented from the system through the expansion tanks, and no air vents will be required for any of the booster coils. Also, drain valves will not be required for any of the booster coils, since the system can be drained through the return mains.

Both the supply and return connections for the relatively few convectors that are used to heat corridors and other interior areas are taken off the bottoms of the mains. This is done because the convectors are on the first floor, as compared to the booster coils, which are in the pipe space below the first floor. This piping hookup will eliminate the possibility of air in the mains causing the convectors to become air bound. The convectors will have to be vented, however, to eliminate the air in the branches from the mains. Since the return connections from the convectors are taken off the bottom of the return mains, drain valves will be provided for the convectors.

Many of the usual air problems that are encountered in hot water heating systems should be eliminated with this arrangement. Of course,



TURNING VANES turn the air both ways at entrance to the plenum chamber, and air deflectors turn the air upward against perforated metal plates, as shown in this mock-up, to obtain uniform pressure equalization



38 FT LONG PLENUM — front elevation shown here — delivers air at a uniform velocity through the slot diffuser although it is supplied by a single duct 2 ft 5 in. wide

this heating system lends itself very well to this method of venting air and minimizing the venting problem in general.

Control Cycle Explained

The air will be delivered from a central air handling unit equipped with outdoor and recirculated air dampers, and a tempering coil. These dampers, when the fan is running, will be controlled automatically, to provide 100 percent recirculation during warm-up periods, and by a mixed air thermostat at all other times. However, a predetermined minimum of outdoor air will be supplied to meet Wisconsin Code requirements for ventilation. The amount of outside air will be varied from this minimum to 100 percent as the outdoor temperature increases.

An outdoor reset fan discharge control will position the preheat valve to maintain tempered air temperatures in accordance with outdoor temperatures. With this arrangement, the discharge temperature will be increased slightly, as outdoor temperatures drop, rather than shifted downward in control point, due to the inherent offset characteristic of a proportioning control.

An electronic temperature control, with its sensing element in the classroom, positions a reheat valve so as to heat the supply air in accordance with the room requirements.

All the room sensing elements, through their amplifiers and an outdoor element, are arranged so that higher room temperatures will automatically be maintained during severe cold weather. For example, a room air temperature of 75 F can be maintained at −10 F outdoor temperature and can be proportionately decreased to a room air temperature of 71 F at 71 F outdoor temperature. This type of room air temperature compensation, which is adjustable, will provide occupancy comfort and will also eliminate the usual need for making manual temperature adjustments to the room thermostat as outdoor temperatures go through their entire range.

Since the room sensing element is a coil of wire without contact points, no difficulty is anticipated as a result of chalk dust and other particles settling on the element.

A control panel will be in the corridor outside each classroom to provide the control point adjustment for that room, as well as a three-position override switch to manually position the valve, if desired. The thermostat settings will be automatically adjusted according to the outdoor temperature.

Location of the room sensing element is not a critical factor. However, tests showed that either of the two side walls, at least 5 ft from the supply outlets, may be used with equal effect. It was found that the wall opposite the diffuser was the least satisfactory. Height and position of the sensing element on the side walls was not found to be significant.

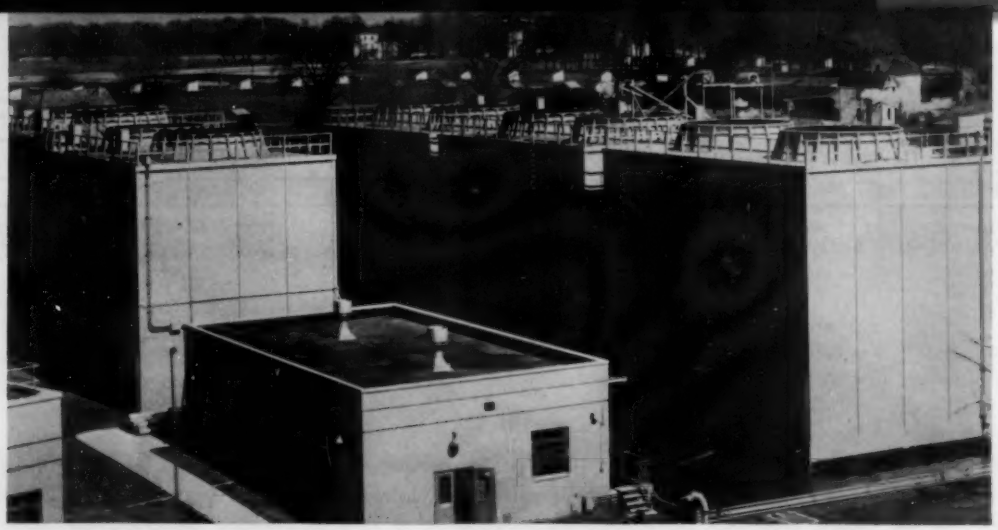
May Eliminate Preheat Coil

Tests also indicated that it might be possible to eliminate the preheat coil. As the thermostat responded so quickly to temperature changes during the tests, it should seldom be necessary to supply air much cooler than 60 F during normal heating conditions. A response test was conducted with a heat lamp input equal to the heat output of 18 students entering the classroom all at once. Only one second elapsed before the thermostat sensed the temperature change and initiated corrective valve action. Even though the response of the thermostat is rapid, the addition of the preheat coil will facilitate the warm-up of the building. The electronic thermostats are sensitive to 0.1 F. It is unreasonable to assume that the classrooms can be controlled as close as that, but the main reason for the selection of these controls was to prevent the large "override" in temperature that is experienced in many existing schools.

Warm-Up Time Is 18 Minutes

"Warm-up time" tests were conducted to see how long it would take for the room air temperature to reach the desired level. With the room air temperature at 60 F, water temperature at 190 F, entering air temperature at 110 F, the warm-up time was found to be about 18 minutes. The air temperature 1 in. from the floor and 1 in. from the shelving at the outside wall was found to be only 1 F less than the thermostat setting at this time. In actual practice, this will probably take longer due to the thermal mass of the furniture and other equipment in the school room.

The decision to use electronic controls on this installation was reached because of the quick response to sudden load changes. With large glass areas, rapid changes in the load resulting from the sun periodically striking the windows are met quickly with the combination of this control system and method of air delivery.



1 EXPOSURE TO THE WEATHER can be damaging to the gear drive when it is not operating. Covering the equipment with a tarpaulin will help protect it

For adequate maintenance and successful operation of

Cooling Tower Gear Drives

. . . check the lubricant and alignment at initial operation, fill the unit with oil during long shutdowns, and follow regular weekly, monthly, and quarterly maintenance schedules

By James E. Gutzwiller
Assistant Chief Engineer,
Standard Products Div.,
De Laval Steam Turbine Co.

2 COOLING TOWER FANS require lubricant change every three months when the speed reducer — worm gear type shown here — is directly in the air stream

GEAR REDUCERS for cooling tower fan drives, to meet the generally severe operating conditions, must not only be specifically designed for the service, but must be properly applied and adequately maintained.

For the induced draft type of cooling tower, the fan is installed in a horizontal plane. (See Fig. 2 for a typical arrangement of drive equipment.) The fan, which draws air through the tower structure and exhausts it at the top, is mounted directly on the upward extended shaft of a right angle speed reducer. An extended floating shaft coupling connects the gear reducer input shaft to the motor, permitting the location of the driver outside of the air stream. The basic setup requires a right angle

speed reducer, of either the worm type gear or bevel type gear.

How to Install Properly

Correct installation, as for any application, is important to insure the proper operation of the equipment. Special consideration, however, is required for cooling tower drive equipment, due to the nature of the structure and the type of loading involved. Most cooling towers are of wood construction and, therefore, may be subject to change in dimension, which may adversely affect the alignment of equipment. Particular differences may be noted in the structure between the wet and dry conditions.

The best practice is to mount the gear reducer and driver on common structural steel members. Gear reducers must be bolted to the supporting members, with the bolts secured by double nuts or other approved locking means. After the couplings are aligned, the gear unit should be dowelled to the supporting members or fixed in the proper horizontal position by means of jack bolts. These precautions are necessary to resist the loosening effect of vibration and the twisting effect coming from fan reaction. After water goes on the tower, it is advisable to recheck the alignment of the fan equipment within a week after start of operation.

Don't Neglect to Check Oil

The importance of selecting the proper grade of lubricant can't be overemphasized. Recommendations of the gear manufacturer should always be followed. The lubricant which is correct for one type of gearing may be entirely unsatisfactory for another type. The location of the speed reducer in the saturated air stream makes it advisable to change the lubricant every three months.

Checking the oil level in the gear box does not always receive adequate attention. The speed reducer is in a rather inaccessible position. In many cases, operation is continuous. Relocating the level indicator, and fill and drain connections to more convenient positions is one way to insure proper oiling. But no matter what type of indicator is used, an accurate check of the oil level can be obtained only after operation has been stopped for several minutes. Such a check should be made at least once a week. At the same time, the units should be examined for signs of excessive oil leakage, and necessary repairs should be made to prevent any abnormal loss of the lubricant.

Typical Maintenance Schedule for Cooling Tower Gear Drives

EVERY WEEK	• Check oil level and inspect units for oil leaks.
EVERY MONTH	• Drain small amount of oil from lowest point in reservoir to remove accumulated moisture.
EVERY THREE MONTHS	• Change oil. • Check coupling alignment. • Check fan blade angles.

Initial Maintenance Outlined

Initial operation of the equipment is critical to subsequent satisfactory performance. The following procedure should be followed:

1) Recheck oil level.
2) Recheck alignment.
3) Turn fan by hand to make sure there is no binding or interference.
4) Jog switch to check rotation.
5) Start operation, listening for abnormal noise.
6) After one week's operation, drain oil, flush reservoir and refill with either filtered oil or new oil. Also, at this time recheck alignment.

Corrosion Is Shutdown Danger

Long periods of shutdown may be responsible for corrosion of internal parts of the gear reducer. The best protection during such periods is to completely fill the unit with oil. Covering the equipment with a tarpaulin will also aid in protecting against the weather. Precautions must be taken to withdraw sufficient oil to restore the proper level before restarting operation. A warning tag attached to the control box can be used as a reminder that the oil level must be adjusted. An alternative procedure to filling with oil is to operate the equipment at least once a week to coat internal parts with an oil film.

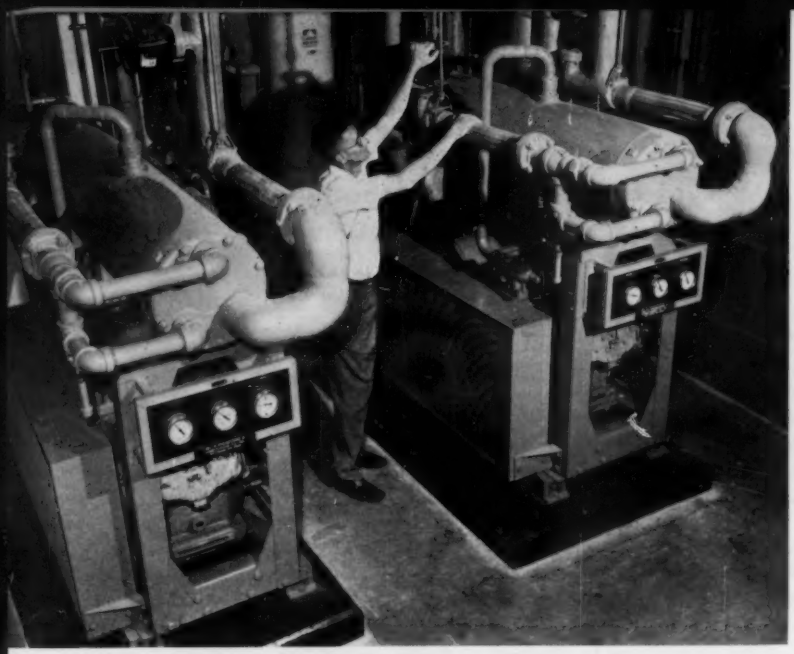
Winter Starts Need Fluid Oil

Starting operation in winter time should be undertaken only when the lubricant has adequate fluidity to lubricate internal parts. The usual practice is to select an oil for cold operation which has a pour point at least as low as the minimum ambient temperature. In some cases, particularly where operation is essentially continuous, the same lubricant is used the year round. If operation is to start when the ambient temperature is below the pour point of the oil, water is admitted to the tower and permitted to circulate for an hour or so to warm up the lubricant prior to startup.

Maintenance Schedule Is Basic

Schedules vary, depending on the type of equipment, installation, and nature of operation. However, the basic points are similar.

It pays to take advantage of shutdown periods or regularly scheduled outages to carefully check equipment, make corrections, and replace worn parts. Minor corrections may well prevent serious failure. ≠



COMPRESSOR INSTALLATION at CIBA Pharmaceutical Products Inc., Summit, N. J., for air conditioning a critical production area consists of two compressor units with 50 hp motors, each producing a temperature drop of 40 F at 670 rpm, with an evaporating temperature of 40 F and a condensing temperature of 105 F.

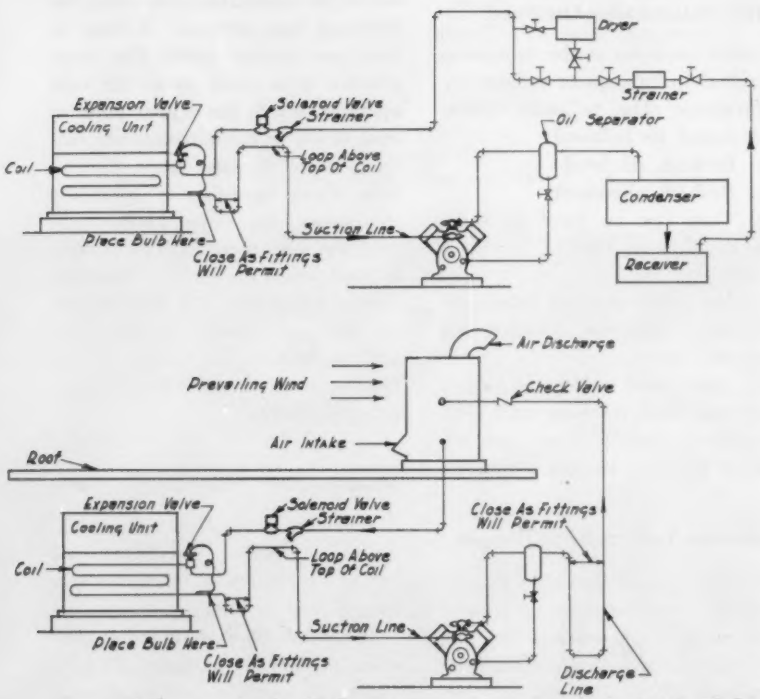
The compressors are equipped with a three-step capacity control.

These units supply a large central station air handling unit arranged with four equal coil circuits. Two coil circuits are taken care of by each compressor.

FOR WIDE VARIATIONS IN COOLING

Multiple Compressors Can Pay Off

By O. B. Wert
Worthington Corp.



1 MULTIPLE COMPRESSORS installed in some cooling systems should have individual condensers and evaporators for each unit. Each cycle operates independently as a separate system

THE ADVANTAGES of installing several reciprocating compressors to supply the cooling effect for a specific installation have not been emphasized enough, in my opinion. This is especially true on jobs of less than 100 tons capacity, where wide variations in cooling requirements exist.

Although the initial cost for the multiple compressor plant may run 8 to 10 percent greater than the system using a single unit for the total load, the benefits obtained will more than offset the added cost.

Weigh Cost If Cooling Ceases

Short interruptions on some installations my not be serious, while on others the effects my be costly. A compressor failure on a two or three unit plant will still allow the system to operate at one-third to two-thirds of capacity, which will, in many cases, hold the load at a somewhat higher temperature without serious handicaps, until the damaged unit can be repaired and put back on the line. Where higher temperatures cannot be permitted, the process production may be reduced to balance the capacity of the compressors operating.

The system, in addition to having separate suction lines to each compressor, has individual discharge lines from the compressor to its shell and tube condenser. The velocity in any of the lines with this arangement cannot fall much below 50 percent of the design value, and oil return to the compressors has not been a problem. As no oil or gas equalization lines are needed, the piping which interconnects the various components presents an orderly appearance.

A third unit has a 20 hp motor and is used on a separate air handling unit.

Many large users of refrigeration equipment, such as chemical and other procesing industries, have purchased standby compressors for such an emergency. Some may not be financially able to have standby compressors, but they can obtain many of the same results by splitting the load among several units.

The multiple compressor plant also permits closer control of temperatures. Plant engineers are demanding more constant control of temperatures because of the control instruments with improved sensing elements which are now available.

Multiple compressor systems are adaptable to almost any size system and to many applications.

Avoid Excessive Unloading

Where it is necessary to design for the maximum wet bulb temperature in air conditioning systems, multiple compressor systems are particularly suited. On such systems, the load may be only a fraction of the installed cooling capacity much of the time, because of such factors as unseasonably cool weather and light occupancy of the conditioned space.

Engineers often design comfort air conditioning systems to account for these wide variations in cooling requirements and specify compressor unloaders to provide as much as 75 percent capacity reduction. Many times, a single compressor is required to operate at 25 percent of its rated capacity for long or short periods. This unloading causes excessive heating of the cylinders, and damage to the compressor may result. If the cooling load requires the use of as much as or more than 50 percent of the capacity, less trouble may be experienced by partial capacity operation.

Balance Load for the Day

Flexibility in equipment operation is another advantage obtained by using several smaller compressors instead of one large unit. The plant engineer can determine whichever compressor or group of compressors most nearly balances the load requirement. Thus, the idle units may be inspected and adjusted and kept ready for their turn in holding the load.

Since most "Freon" compressors are of the multiple cylinder type, it is possible to purchase, for example, a four and a six cylinder unit with the same bore and stroke. In this way spare parts are kept to a minimum and, in addition, the added advantage which unequal tonnage compressors provide with wide load variations is obtained. For example, a 90 ton air conditioning load with 40 F suction and 105 F condensing temperatures could be handled by a system with one four cylinder compressor with a 6⅜ in. stroke and 5 in. bore, operating at 920 rpm and requiring a 100 hp motor.

For the same load, a two unit plant might consist of a six cylinder compressor with a 4¾ in. bore and 3⅝ in. stroke operating at 950 rpm with a 60 hp motor and a four cylinder compressor with a 4¾ in. bore and 3⅝ in. stroke operating at 950 rpm with a 40 hp motor. The larger compressor of the two unit system has an approximate capacity of 55 tons and the smaller four cylinder unit, 35 tons.

Thus, the larger compressor would handle about 60 percent of the assumed 90 ton load and the smaller one 40 percent of the load. With such a combination of compressors and 50 percent capacity control on each unit, the capacities shown in Table 1 might be obtained with selected operation of units and capacity control.

Reduce Short Cycling

It is, of course, possible to make the operation of the compressors and their capacity control entirely automatic to obtain the capacity steps shown.

The multiple compressor job may completely remove the detrimental effects of shortcycling, which occur under light load conditions where one large unit has been chosen to meet the design load. The control for starting and stopping a single compressor may have to be set for a wide differential to prevent too frequent starting of the unit. This is not necessary where multiple units are used.

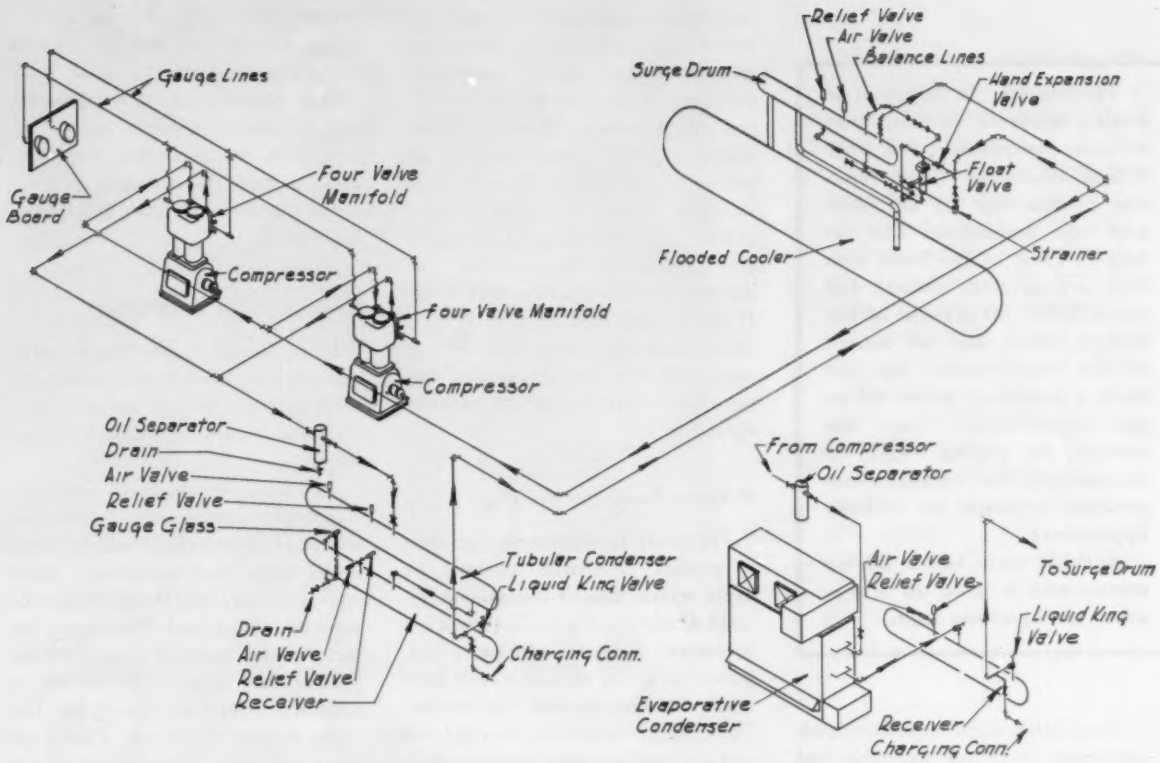
Each Cycle Is Separate System

Where load variations are large, cooling systems using two or more compressors and "Freon 12" as the refrigerant are less likely to have operating troubles at partial capacity if they are designed so that each compressor has its individual condenser and evaporator. The suction and discharge lines in each cycle will be sized for its part of the total plant load. Since one or more compressors may be shut down due to a light load, the remaining unit or units

TABLE 1—SELECTED OPERATION of two unequal compressors with 50 percent capacity control can achieve various required capacities for a 90 ton air conditioning system, as shown here

	Compressors Operating, Percent	
Required capacity, percent	60 hp motor; 4¾ in. bore × 3⅝ in. stroke; six cylinders; 950 rpm	40 hp motor; 4¾ in. bore × 3⅝ in. stroke; four cylinders; 950 rpm
100	100	100
80	100	50
70	50	100
60	100	*
50	50	50
40	*	100
30	50	*
20	*	50

* Compressor not operating



2 A COOLING SYSTEM using ammonia may be arranged as shown here for satisfactory operation of multiple compressors

will be operating closer to their full capacity.

Thus, the gas velocity in both suction and discharge lines will not fall to too low a figure, as might occur with a single unit system, or where common discharge and suction lines are used on multiple compressor systems. The oil will travel with the refrigerant vapor and be returned to the compressor crankcase in the usual way.

Cycles Are Independent

Each cycle will operate independently as a separate refrigeration system, as shown in Fig. 1. The evaporators for the total tonnage may be in one casing or shell. The same arrangement may be used for the refrigerant condensers. Each of these components are then arranged with double coil or tube circuits, depending on the design selected to best suit the job requirements. Many problems will be eliminated if the systems are kept separate.

Where ammonia is the refrigerant, the system may be separated as in Fig. 1, or combined, as in Fig. 2, for equal performance.

The use of ammonia as a refrigerant has held its place in certain industries for a number of reasons. The ease of adding units to an existing system — as shown in Fig. 2 — on both the high and low sides, is one of these advantages. Systems using ammonia compressors may be split up into the sizes that will best fit the expected load requirements throughout the operating year.

Great Variation Possible

Great variation in capacity can be attained, since any or all of the compressors may be operated with the total coil or evaporator surface. For example, if a 60 ton system were required by a process to operate at 5 F evaporating temperature and a 15 F temperature difference, one 40 ton and one 20 ton compressor could be installed to do the cooling. It would be possible to obtain 44 tons with the larger compressor, and 23.6 tons with the 20 ton unit, when either was operating on the full evaporator surface installed for 60 tons, because of the higher evaporating temperature and smaller temperature difference at partial load conditions.

The evaporator and condenser on an ammonia system may be supplied in two or more parts, and with proper valving any compressor may operate on any part of the system. This is especially desirable on the high side, as it allows the operator to clean the condenser tubes when necessary without a complete shut down of the plant.

Where it is reasonable to expect the business or process to grow, the suction and discharge lines may be oversized on the initial installation, at slight additional expense, without detrimental effect on operation. No problems are encountered in line sizing for oil return to the compressors and equalizing lines. ∓

Contractor finds device invaluable for cutting holes in right places — avoids guessing, saves time and money.

By Porter V. Taylor

Electronic Detector Tells Where To Install Wall Air Conditioners

THE PROBLEM of where to cut a hole through a wall without running into electrical wiring, steel beams, piping, or other metal objects is being solved by one contractor with an electronic device which he has made. The instrument locates and traces the paths of metal objects even when they are concealed in poured concrete. It also gives a fair idea of the sizes of the objects being traced.

The Mahoney Air Conditioning Installation Service, which developed it, finds it an invaluable aid in installing room air conditioners. According to David A. Mahoney, president, savings on just one contract for 60 units in a large hotel equaled the first cost of the instrument, about $400.

On this job—the King Cole hotel, Miami Beach—over 60 of the 84 units were installed in walls which had to be cut through, with the rest being installed in windows. In many cases, the detecting instument made it possible to select the hole for the installation space where no electrical conduits or pipes were present. In other instances, the walls were so thoroughly saturated with wires, piping, and other services that it was impossible to find a clear space large enough for the unit. In these cases, the detecting instrument was still very helpful because it selected the areas with the least obstacles and made it possible to determine useless areas.

Housed in a small metal box not much larger than a cigar box, the unit consists of a series of tubes and condensers plus a radio speaker. The finding portion is a small antenna which is plugged into the top of the box. By aiming the antenna at a blank wall and moving it about, metal concealed behind wood, plaster, or concrete is easily located and traced.

When no metal is in the path of the antenna, a loud buzz is given off through the speaker. However, when metal is present, the volume of the noise decreases sharply in proportion to the amount of metal. When brought in close contact with such objects as steel beams or other metal objects, the sound is completely shut off.

Thus, with little experience, an operator can take this box and move it over portions of a wall and determine whether it is safe to cut through the wall without encountering hidden objects.

It has virtually eliminated the old problem of starting to cut a hole through a concrete block wall only to have to seal the hole up and start another one.

The device is portable, operating on two 1½ volt dry cell batteries and a larger XX45 dry cell battery. The machine operates with a trigger switch, and a spring automatically cuts the current off when the trigger is released. Volume control is also adjustable.

This is not the first time Mr. Mahoney has come up with an answer to problems in his field. He was instrumental in developing a precast concrete frame for wall air conditioning units, which is used now in south Florida construction. The frame, which is built into the wall at the time of construction, permits easy installation and removal of units. It may also be built in during construction and plastered over until some later date when a unit may be installed.

Mr. Mahoney also recently came out with a metal cover which protects the exterior portion of wall air conditioning units. This cover prevents damage to the unit by weather and also eliminates wall discoloration from condensation. It has a special attachment which can cover the unit completely when not in use or during hurricanes. ∓

PRINTING PLANT, press home of 30 publications, including Heating, Piping & Air Conditioning, recently installed a new automatic fire extinguishing sprinkler system "to protect our ability to produce for our customers"

Automatic Sprinkler System Protects Printing Plant

By Glenn I. Kientz

District Manager,
H. G. Vogel Co., Inc.
Engineers-Contractors

. . . and reduces insurance rates for the Wayside Press, Mendota, Ill. Consisting of 561 sprinklers, supplied by 8000 ft of piping ranging from 1 to 8 in. in diameter, this newly installed modern fire protection system has been designed for plant expansion, too.

A NEWLY INSTALLED $20,000 fire protection system at the Wayside Press, Inc., Mendota, Ill., incorporates the latest development in automatic sprinklers for printing and paper storage occupancies. The water supply is provided by a connection to the public water main in the street. An 8 in. supply main is reduced as the piping extends through the building to a minimum of 1 in. The design provides minimum residual pressure of 15 psi at any point in the system with a sufficient number of sprinklers operating to discharge 750 gpm.

Elevations of the piping and friction losses for the pipe and fittings dictated the piping sizes throughout the system. In all, about 8000 ft of piping is used to supply 561 sprinklers. A variety of hangers are used because of several types of construction incorporated in the plant. In all cases, the maximum calculated load plus a safety factor of 5 was specified for pipe supports because the weakening heat of fire must be resisted to keep the sprinklers in effective operation under the most adverse conditions. Due to the fire hazard inherent in all welding operations where combustibles are present, no welded hangers or welded piping connections were permitted.

Consideration has been given to continued plant expansion, which is feasible in three directions, and which may be done by extending the piping system from the point where new building construction may start.

Spray Lowers Temperature

The automatic sprinklers are a new "spray" type which break up the water stream into particles of fine mist and small drops. The fine particles coming in contact with flames or heated air will be almost instantly changed into steam, effecting rapid cooling below ignition temperatures. Somewhat larger particles which resist ambient temperatures will be still so light in weight that they will be carried upward by convection currents, completely saturating ceilings, beams, and other structural members at the highest levels in the area of the fire. The largest particles will have gravity force sufficient to fall and saturate everything below the sprinkler deflectors.

In general, the sprinklers are set to fuse at 165 F. In proximity to unit heaters, steam lines, boilers, melting furnaces, and other sources of benevolent heat, the fusing element is set for at least 50 F in excess of the expected maximum temperature. The location of each sprinkler was determined by an engineering survey, and the areas covered vary with construction, occupancy, and structural or equipment interference with effective distribution. The average area covered is about 85 sq ft per sprinkler, with a maximum of 128 sq ft.

For additional protection, a Siamese pumper connection is mounted outside the building and connected to the sprinkler system so that firemen may follow the recommended practice of fighting fire through the

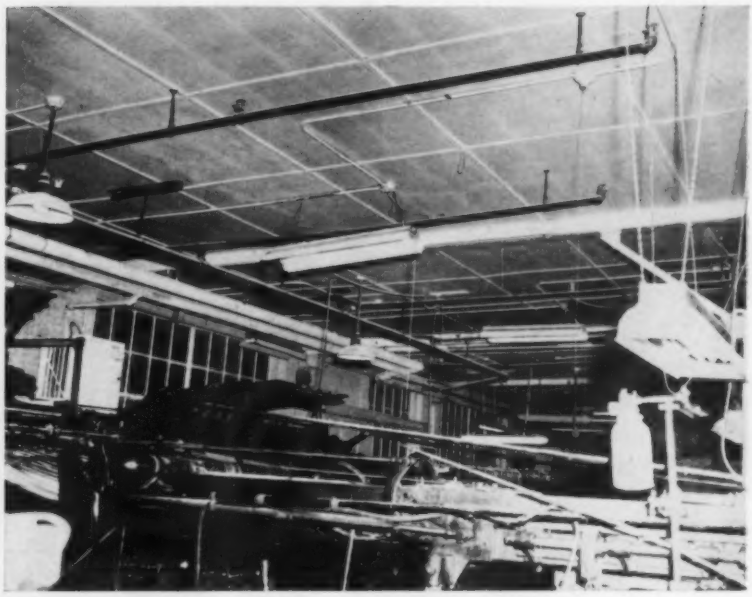
sprinkler system by increasing pressure and the supply of water if the fire is not extinguished before their arrival. This connection is in a spot protected from exposure to fire in the building and as close as possible to the nearest city hydrant.

Use Anti-Freeze in Truck Area

In two truck dock areas that are sometimes open to the weather, a trapped solution of propylene glycol has been used in the sprinkler piping to avoid the possibility of freezing. This chemical is ideally suited to the duty, as it is non-toxic, has a low coefficient of expansion, and has a specific gravity close to that of water.

Installation took about a month, and was accomplished without interference with printing schedules of the 30 publications printed at Wayside.

The fire insurance rate paid by Wayside Press before sprinklers were installed was about 50c per $100.00 value of equipment and other contents. The present rate with sprinklers is 7c. Insurance on the building, use and occupancy, and extended coverage are similarly reduced. Also, terms of payment were negotiated whereby the insurance savings will amortize the cost of the system without capital investment.



SPRINKLER SYSTEM consists of 561 sprinklers at 8 ft intervals in a network of 8000 ft of piping. Installation required one month

Automatic Sprinkler Nearly 100 Years Old

SINCE Ctesibius, in the third century before Christ, invented what ancient historians called a "fire extinguishing machine," the technique of fire protection has closely paralleled advances in science and technology, and today fire protection engineering has professional status.

The greatest improvement in private protection came with the invention of the automatic fire sprinkler in 1864 by Major A. Stewart Harrison, first engineer in an English regiment. Similar devices were invented independently in this country only a little later, and it is in the U. S. and Canada that development and use of mechanical means of fire protection has flourished.

Water is the natural enemy of fire and also has the virtue of being available in practically unlimited quantities wherever groups of people live and work. While various chemicals and compounds have merit as extinguishing media, their cost of manufacture, containment, and transportation has forced the utilization of water to optimum effectiveness so that now automatic sprinklers are made in a great variety of shapes and styles for specific hazards. High voltage electrical transformers, liquefied petroleum gases, factories producing explosives and other equally surprising fire hazards are most successfully protected with automatic sprinklers. Over 96 percent of all fires, in situations where automatic sprinklers were involved in the past 60 years, have been successfully controlled. The failures were mostly attributed to lack of maintenance, protection out of service, and similar factors. Only a small fraction of 1 percent were due to hazards too severe for the sprinkler arrangement provided.

Popular misconceptions concerning automatic sprinklers include great water damage and frequent operation without fire. Neither has any basis in fact. Each sprinkler operates independently in incipient fire and applies water only in the small area it guards. If the fire spreads, adjacent sprinklers are involved until the fire is under control. One of the large insurance groups conducted an investigation as to the number of sprinklers operating without apparent cause. Based on over 15 million sprinklers in plants they insured, on the average about 1 per year in each million operated from undetermined causes. Many of these were older and less reliable types which had seen long years of service. ≠

ALGOMA CENTRAL TRAINS are kept running on time with the help of steam generator heating cars, as well as a new steam plant in the main shop

Unit Steam Generators Heat Railroad Shops and Trains

. . . for Algoma Central railroad in subzero temperatures

By Roy Anderson

Superintendent of Motive Power
Algoma Central Railroad

FIVE automatic oil fired, package type steam generators recently installed for the Algoma Central railroad heat its main shops and offices in Sault Ste. Marie, Ontario, Canada. Other units in rolling heater cars heat passenger trains pulled by freight diesels.

Among the advantages noted are great savings in labor and great flexibility in operation and control.

The bank of steam generators in a corner of the diesel locomotive shops produces 30 to 500 hp of steam, corresponding to 800-15,000 lb of steam an hr to meet the widely changing steam load of the shops. In the summer, 800 lb of steam per hr at 80 lb pressure is used for steam cleaning locomotive parts and filters in the shops. In the winter, more steam is needed at reduced pressure to heat the 3,313,000 cu ft of space in all the shops and office buildings and railroad passenger cars on the outside ready track.

The Algoma Central has been using these steam generators for over three years to heat their diesel passenger trains which operate in cold weather, often 30 below zero F. Because they worked out successfully on trains, they were selected for the steam plant in the main shops. Parts

are interchangeable between the steam generators in the trains and the units in the shop.

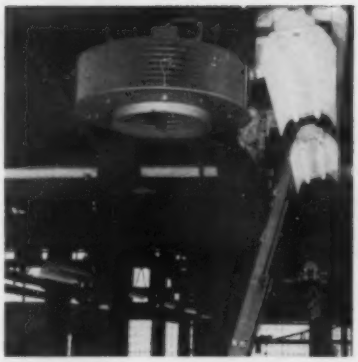
How Master Control Works

The master control turns one, two, three, four, or all five of the steam generators on or off as needed to meet the changing steam load of the shops. On a cold morning, when it is 20 below zero, four or five steam generators may be used to heat the shops. As the sun comes out and the temperature rises, say to zero at mid-day, then one or two of the steam generators may be turned off by the master-control, then automatically on again when the temperature drops.

Assume that three of the five steam generators are handling the steam load, making 9000 lb of steam per hr and maintaining the desired 80 lb steam pressure on the header. Then assume that the steam demand goes up and the steam pressure in the header drops to 70 psi. This immediately actuates a low-pressure switch on the master control panel which causes the master-timing motor to start turning clockwise.

In less than two minutes a cam on the master-timing motor shaft closes a switch feeding current to a unit timer on the No. 4 steam generator. Thus, as the unit timer motor turns, a cam closes a switch which turns on the motor that drives the steam generator's water pump, blower and fuel pump. The motor runs for 40 seconds, pumping water into the coils and purging air through the combustion space. Then the unit timer actuates a second switch, releasing atomized fuel oil under pressure into the combustion space, the No. 4 steam generator lights up, the unit timer stops. A continuous spark insures immediate lighting. Within 80 seconds this unit develops 80 lb working steam pressure and produces an added 3000 lb of steam per hr to handle the increased steam load and the master timer then stops. If this fourth unit does not supply enough extra steam to meet the steam load, the No. 5 steam generator is turned on in a similar manner.

Now assume that the steam load drops from 12,000 lb per hr to 8500 lb per hr. The header pressure rises to 85 psi, which causes the high-pressure switch on the master control to make contact, feeding a current to the master timer which causes the master timing motor to turn counter clockwise. Within two minutes the No. 4 cam actuates a switch on the shaft, feeding current to the unit timer motor on the No. 4 steam generator. The solenoid fuel valve closes, shutting off the fuel. However, the steam generator motor continues to run two minutes, in order to refill the coils with water, so that the steam generator is ready to make steam again when called upon. After the two minute refill cycle, the motor on the No. 4 steam generator stops.



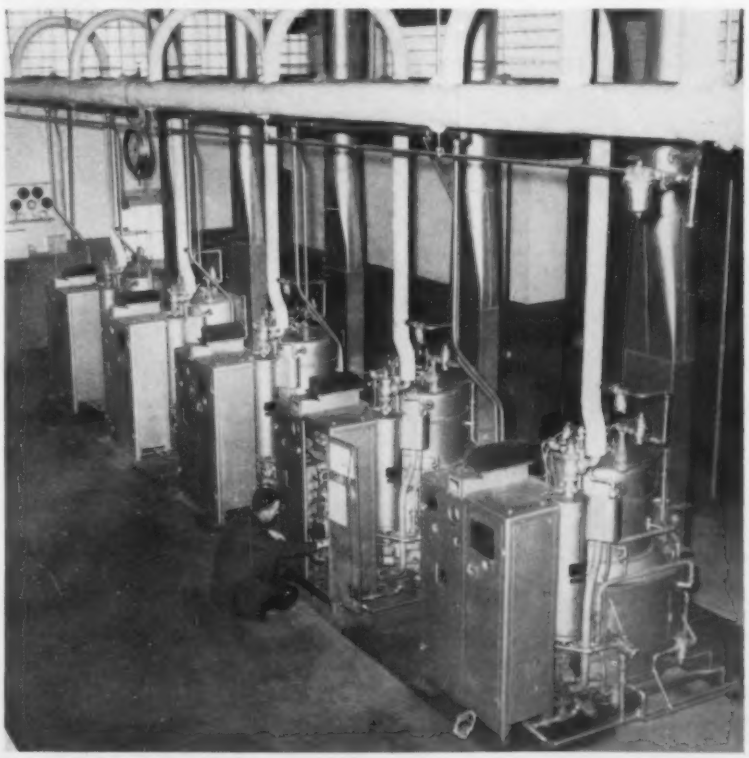
SPACE HEATERS suspended from 30 ft ceilings in shops are thermostatically controlled. This unit has a 2½ hp blower motor circulating air over coils supplied with steam from the central plant

During the starting period, the steam separator does not become water logged because a steam trap releases excess water until the steam dries out.

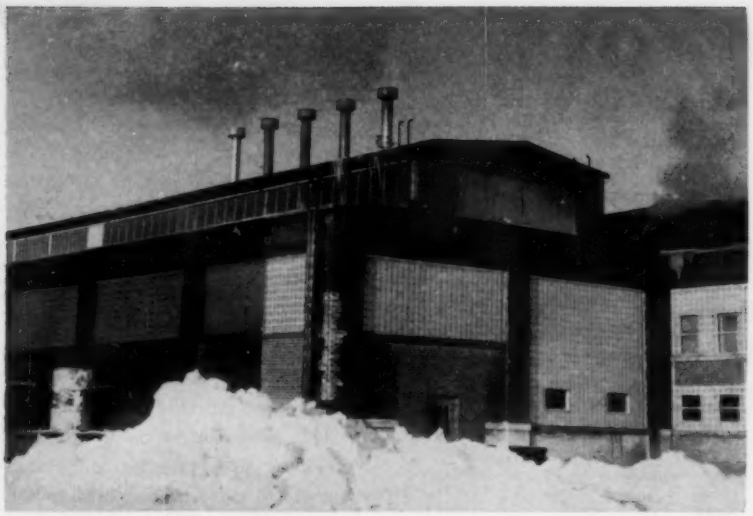
The servo-control on each steam generator meters the fuel oil, water, and air to produce one-third to full steam capacity at 80 percent thermal efficiency.

Rebuild Boiler Plant

After the previous heating boilers were removed, the boiler room section of the diesel shop building was rebuilt, using large glass blocks. A



FIVE STEAM GENERATORS operate singly or in various combinations, governed by the master controller on the wall at left. The servo-control on each meters fuel oil, water, and air to produce one-third to full capacity

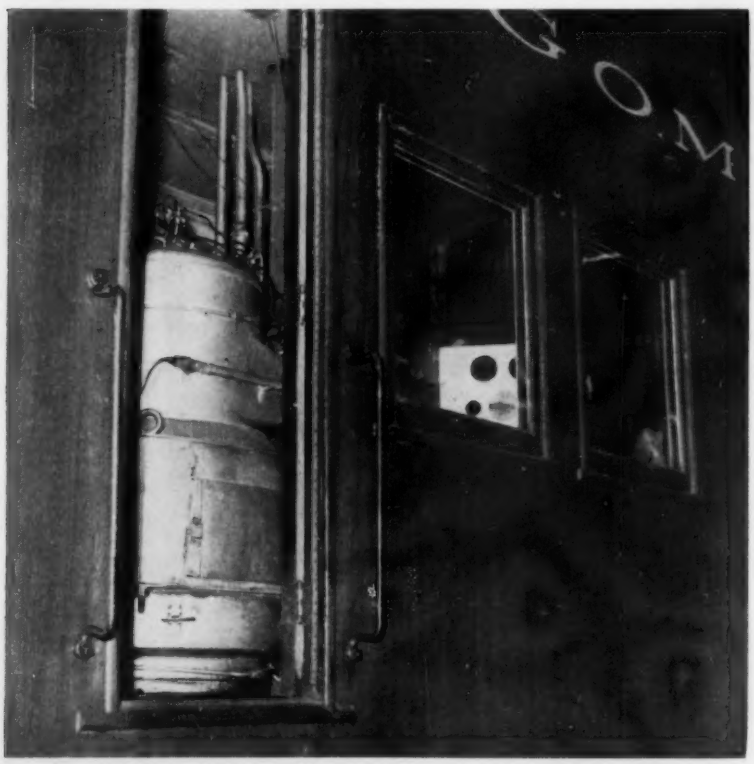


FIVE EXHAUST STACKS rise from the five steam generators in this glass block steam plant of the Algoma Central railroad. Clouds above stacks are moisture precipitating at 18 below zero F

4000 imperial gallon fuel tank was bricked in at floor level with oil pipes from the larger tanks in the yards. A 3000 imperial gallon feed water tank was fabricated in the shops and put next to the fuel tank.

All water, fuel oil, and blowdown piping to the five steam generators in front of the fuel and water tanks is in a drain trench behind the units. A metal grating covers the trench.

Steam from each steam generator goes into an 8 in. steam header about 8 ft above the steam generators. Several steam pipes for the different shop buildings are taken off the steam header. Steam at a pressure of 80 psi is piped all over the diesel shop to the thermostatically controlled unit heaters hung from the ceiling and to the steam cleaning guns. Reducing valves are in the steam lines that supply the office building and passenger cars outside.



HEATER CAR STEAM GENERATOR supplies steam as needed to heat passenger train pulled by a freight diesel. A 600 gal fuel oil tank and a 3000 gal water tank in the car are sufficient to heat the train for three round trips on the railroad. These generators may be used for heating the trains up to a pressure of 300 psi, if needed

A vacuum pump on the heating system returns all steam condensate in the system to the feedwater tank, except the steam used to heat the 12 to 18 passenger cars outside and steam used for hot jet cleaning.

All feedwater to the steam generators is treated for hardness. Accurate records are kept on feedwater control so as not to over-treat the water.

A straight metal exhaust stack from each steam generator rises about 7 ft above the roof, fitted with a rain cover so as not to obstruct the flow of exhaust gases. Each steam generator has a forced draft fan.

Automatic Controls Take Over

When this new automatic steam plant was first laid out, space was arranged for a sixth unit. However, the five machines are handling the steam load adequately. In fact, all five are seldom used at the same time. The controls are arranged so that each machine is used an equal number of hours.

Photos courtesy Vapor Heating Corp.

HEATED PASSENGER CARS stored outside shops require steam at 50 psi from the steam plant 24 hours a day. Fifteen to 20 coaches are kept warm ready for use

Once started, automatic controls take over, followed by an occasional checking during the day to see that the units are running properly, making steam only in the amount that is used. Also, in the master control is an alarm circuit that rings a bell in case a unit does not ignite properly. In this case, this unit is passed, and another unit is turned on. Then an attendant can check the passed-up unit before starting it manually and putting it back on the line.

A regular preventive maintenance program calls for daily checking of the steam generators. Certain parts are checked at 30 day intervals. Blowdown is automatic.

Labor savings being realized by this installation will pay for the steam generators in a few years. ⫩

Cunard Building Gets Air Conditioning

. . . goliath system installed

ONE OF THE LARGEST and most complete air conditioning systems ever installed in an existing structure was recently completed in the Cunard building at 25 Broadway, New York. It cost more than $3 million. The 22 story building has a net rentable space of 580,000 sq ft and over 100 tenants. The installation was completed in 11 months, with most of the work being done during normal business hours.

Equipment includes two 935 ton steam turbine driven centrifugal compressors in the subbasement. Chilled water is distributed through 16 in. supply and return lines.

A cooling tower on the roof was installed without extra support when the existing steel was determined more than adequate to carry the additional load. The tower is also supplied by a 16 in. supply and return.

Two elevator shafts are used for the chilled water risers, as well as for the outdoor air supply. An existing ventilation shaft is used for the condenser water pipes.

Individual control at each fan-coil unit is provided three major tenants on floors 12 through 22. Chilled water is piped to each of the 56 risers for these units at the 11th floor.

Existing ductwork was utilized to service the Great Hall, one of the show places of lower Manhattan. This hall is 65 ft by 185 ft and is four stories high.

An IBM electronic control board is used to start and stop all fans and fan-coil units. It is believed to be the first installation of its kind applied to an air conditioning plant.

During the off season, a 100 percent supply of outdoor air is delivered throughout the building. During the heating season, the upper floors work on a reverse cycle, with hot water circulated through the fan-coil units and tempered outdoor air supplied by the primary air handling unit. The lower floors retain their original heating system supplemented by 25 percent tempered outdoor air.

The air conditioning contractor was Kerby Saunders, Inc. ⫩

Room Air Conditioner Sales Hit 1.3 Million

. . . all-time record

ROOM air conditioner sales reached an all-time high during the 1955 selling year of about 1.3 million units, compared with about 1 million units during 1954, according to the Air-Conditioning and Refrigeration Institute.

At the same time, factory and distributor inventories are sharply down from August.

The hot weather in many sections of the country during July and August was a major contributing factor in producing this situation. ⫩

How to Control High Velocity

• **It's easy to control double duct high velocity air distribution systems for year 'round air conditioning, says the author. Some of the steps involved are maintaining static pressure balance, controlling fan volume, locating static pressure sensing tips, and selecting temperature controls. The first two are discussed here.**

By Norman J. Janisse

Assistant Chief Field Engineer, Johnson Service Co.

DOUBLE DUCT high velocity air distribution systems for year 'round air conditioning are increasing in use. And experience with a large number of these systems in various types of buildings has already shown that they are fundamentally simple to control.

The object of any air conditioning control system is to obtain the desired space conditions. In a double duct system, space temperature control is accomplished with relative ease by thermostatic operation of a valving device or damper at each room mixing unit. Since this control method does not depend on changes in the volume of air delivered to the space, it should function with virtually no disturbance to air distribution patterns and should introduce no new noise problems. To accomplish this, however, control of total fan volume or duct static pressures should be employed.

As an aid in maintaining a constant air flow pattern through each duct, it is desirable to vary the duct temperatures in accordance with the system load. However, the air in the hot and cold ducts must be at a temperature that will always satisfy the space having the most extreme requirements. Because dehumidification requirements greatly limit the temperature variation permitted in the cold duct, changing load conditions are normally satisfied by varying the air temperature in the hot air duct.

The higher static pressures of high velocity double duct systems present a simpler control problem than the lower static pressures used in low velocity installations. In a high velocity system the mixing unit is designed to operate under relatively high pressure drops. Small variations in the high static pressure present in the duct at the mixing device, therefore, have comparatively little effect on the flow of air through the unit, especially since the flow varies as the square root of the pressure drop.

However, air distribution at high velocities presents some problems not usually found elsewhere. One is the elimination of sounds created by the high-speed fans often required to move the air at these high velocities. The swift movement of air over or through duct fittings and obstructions also produces a noise problem. Both of these problems, however, are overcome by incorporating such sound attenuating features as fan silencers, large radius bends and special types of flexible connections into the design of the ducts. Additional sound absorption is provided at the individual mixing units, where the air is introduced into the areas which are being conditioned.

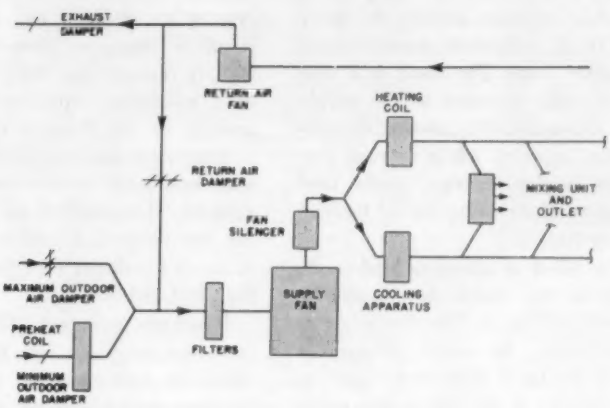
A typical mixing unit incorporates an air valving device, which reduces the air velocity and static pressure to acceptable low levels and also regulates the amounts of hot and cold air admitted to a mixing chamber. This blends the air mixture at the desired temperature and absorbs the sounds created by high velocity air flow. Also incorporated is a diffuser for introducing the blended air at normal low velocity into the conditioned area. Since the air delivered to the room mixing unit is at two different temperatures, a standard room thermostat can be used to control the operation of the air valving device.

Double duct systems, in general, permit good flexibility in zoning. They can be zoned effectively to handle the individual air conditioning needs of areas with different heat loads and exposures. For example, double duct systems are often zoned and controlled to satisfy the varying requirements of exterior areas that are constantly affected by outdoor temperature changes, sun, wind, and the fairly constant cooling loads of interior areas.

Components of a typical double duct high velocity system are shown in Fig. 1. Although the arrangement indicated is not necessarily the best one suited for all double duct systems, it includes all of the components commonly found in such a system.

In many cases, the supply fan and return air fan are equipped with inlet vanes, variable speed drives, or other control devices. These are used for varying the fan capacities or for

Double Duct Systems



1 TYPICAL DOUBLE DUCT SYSTEM has components arranged as shown here. Many systems vary somewhat, depending on the climate and other factors

maintaining constant capacity under varying load conditions.

Although the preheat coil is shown in the minimum outdoor air duct, it may be elsewhere. It is sometimes in the return air duct to eliminate the danger of coil freeze-up. In some areas, the temperature of the desired minimum quantity of outdoor air when mixed with the return air will always be higher than that which could cause freeze-up. No preheat coil is needed in such areas. In other areas, a precooling coil may be required. In still other areas, both a precooling coil and a preheat coil may be needed.

The heating and cooling coils are normally installed in their respective ducts immediately after the supply fan and fan silencing apparatus. The heating coil handles the sensible heating load, while the cooling coil provides both sensible and latent cooling. Where large percentages of outdoor air are used, especially in warm or humid climates, the cooling coil is sometimes installed ahead of the supply fan. This permits the moving of larger quantities of air at a lower temperature, thus providing more dehumidification and cooling.

The cooling coil is usually controlled by a duct-type thermostat, set to maintain the air in the cold duct at a constant dew point temperature. In some areas, spray washers or humidifiers may also be used to control relative humidity.

The return air damper, outdoor air dampers, and exhaust damper are controlled to provide minimum ventilation or, when the outdoor temperature permits, to produce cooling without mechanical refrigeration.

maintaining static pressure balance

As the air flows through the supply ducts, internal friction within the turbulent air stream, and friction produced by air coming in contact with duct surfaces and obstructions, reduce the total pressure within the system. The pressure drop caused by friction at any point in the system is determined by the velocity of the air and the duct size. If the pressure drop is reduced by an increase in duct size or by other means, it is apparent that the total and static pressures required to move the air are also reduced. The natural result is an increase in fan capacity.

One of the main objectives in a double duct high velocity system is to maintain a proper static pressure balance throughout the system. This insures a constant flow of conditioned air from the individual mixing units at all times, even under varying load conditions. The result is a constant flow pattern within the space.

The effects which changing load conditions have on the static pressure in a typical system employing a single supply fan are shown in Fig. 2. The values in Fig. 2 do not necessarily indicate the actual pressures found in any particular installation. However, they illustrate the approximate pattern of static pressures found in a typical installation.

To simplify the explanation, it is assumed that the hot and cold ducts are sized to handle equal quantities of air. In actual systems, the hot duct — because of the high temperature differentials which can be used in this duct — is often sized to handle a smaller quantity of air than the cold duct.

It is also assumed that the ducts are designed on an equal pressure drop basis. Any effect of static regain is not included in the calculations.

The distribution system in Fig. 2 has been divided arbitrarily into four equal parts, with each part getting one-fourth of the total air volume. The system is designed to operate at a static pressure of 4 in. water gage at the supply fan, with a pressure drop of 1 in. WG between each duct take-off when all of the air is

flowing through only one duct. The letter M represents the mixing units on each branch duct.

The figures in the table indicate the static pressure at each branch duct for three different load conditions: 100 percent cooling for Condition X; 75 percent cooling and 25 percent heating for Condition Y; and 50 percent cooling and 50 percent heating for Condition Z.

In Condition X, all of the air used by the mixing units is supplied by the fan through the cold duct. Since the hot duct supplies no air, the static pressure at all points in this duct is equal to the static pressure at the supply fan, 4 in. WG. However, as indicated in the table, the pressure drop between each cold duct take-off is 1 in. WG.

If the load changes from Condition X to Condition Y, both ducts are now used to distribute the air. The result is lower air velocities, which produce lower pressure drops within the distribution system. These lower pressure drops reduce the static pressure at the supply fan, resulting in an increase in fan capacity.

As the load changes to a condition requiring an equal amount of hot and cold air — Condition Z — the pressure drop through each portion of the cold duct decreases, since less air is being delivered through this duct, while the pressure drop in the hot duct increases slightly. As shown in Fig. 2, both ducts produce equal pressure drops. The result is a new, lower static pressure at the supply fan, accompanied by another increase in fan capacity, which in turn produces another increase in the total quantity of air being moved through the system.

The effect of changing load conditions on the double duct system is shown in Fig. 3. The fan pressure curve gives the static pressure at which the fan is delivering a particular quantity of air. The system resistance curves for Conditions X, Y, and Z show the static pressure required to move a particular quantity of air at these load conditions. The point at which the fan pressure curve intersects each system resistance curve gives the static pressure at which the fan is operating and the volume of air delivered by the fan at this pressure.

The fan operates at a lower static pressure in Condition Y than in Condition X, and in Condition Z it operates at a still lower static pressure. The reason for this is that the pressure drops decrease as the load changes from a condition requiring 100 percent air through one duct to a condition requiring three-fourths of the air through one duct, and then to a condition requiring an equal amount of air through each duct.

Also, each decrease in static pressure results in an increase in fan capacity. If no controls are provided, the fan delivers a greater quantity of air in Condition Y or Condition Z than in Condition X.

However, it is not desirable to introduce more air into the system when the load changes, since such increases would produce greater air velocities, which in turn could lead to additional noise problems and possible disruption of air flow patterns in the conditioned areas. Instead, the system should operate so that approximately the same quantity of air is delivered by each mixing unit under any load condition.

There are two control methods available for accomplishing this goal: fan volume control and control of static pressure within the ducts.

controlling fan volume

Fan capacity can be controlled by means of inlet vanes, variable speed drives, or other fan capacity control devices. This control method results in the same fan capacity at different static pressures. This fan capacity is represented in Fig. 4 by line XA.

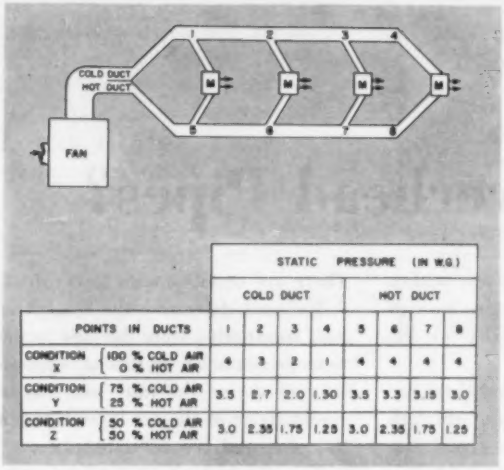
Fig. 4 also shows what happens to the fan pressure curve when fan inlet vane control is applied to a double duct high velocity system in which the system load varies. If the fan is controlled so as to deliver the same volume for all load conditions, it is apparent that, for Conditions Y and Z, the reduced pressure drops within the system result in a new fan static pressure lower than the static pressure required to overcome the higher pressure drops found in Condition X.

Therefore, the original fan pressure curve is shifted downward until it intersects the new system resistance curve on line XA at a new static pressure. This is shown in Fig. 4 by the dotted fan pressure curves for Conditions Y and Z. Points Y′ and Z′ are the new static pressures at which the fan operates in satisfying Conditions Y and Z when fan capacity control is used.

If no fan capacity control is used, the original system resistance curve shifts a great amount when the load is changed. Fan capacity control keeps this shift at a minimum.

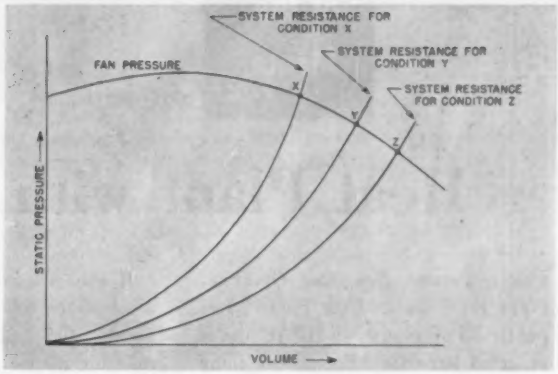
Fig. 5 demonstrates what happens to the fan pressure and system resistance curves for Condition Z in relation to Condition Y when fan capacity control is employed. Conditions Y and Z are used because they represent shifts in system characteristics which more logically exist in actual systems to which fan capacity control is applied. The new fan and system curves for Condition Z must intersect at a point on line XA. It is apparent, therefore, that the new system resistance curve for Condition Z represents less of a shift from the system resistance curve for Condition Y than the shift represented by the original system resistance curve for Condition Z. The dotted lines are the new fan pressure and system resistance curves for Condition Z. Fan capacity control has prevented an increase in capacity, thereby decreasing the total friction pressure drop, which makes pressure variations throughout the system less extreme at a new fan static pressure.

Fan volume control is especially suitable for zones where load conditions remain relatively constant throughout the year. Since there is very little variation in load, the flow pattern of air distributed through each main duct by the single fan is fairly constant, resulting in relatively constant pressure drops and veloci-

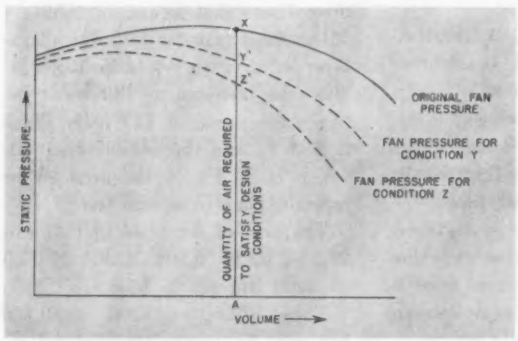


		STATIC PRESSURE (IN W.G.)							
		COLD DUCT				HOT DUCT			
POINTS IN DUCTS		1	2	3	4	5	6	7	8
CONDITION X	100 % COLD AIR 0 % HOT AIR	4	3	2	1	4	4	4	4
CONDITION Y	75 % COLD AIR 25 % HOT AIR	3.5	2.7	2.0	1.30	3.5	3.3	3.15	3.0
CONDITION Z	50 % COLD AIR 50 % HOT AIR	3.0	2.35	1.75	1.25	3.0	2.35	1.75	1.25

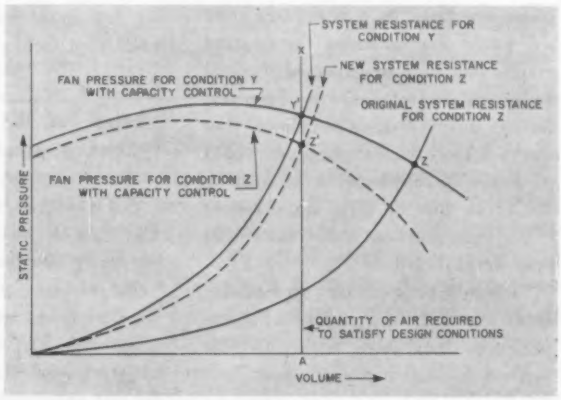
2 EFFECTS OF CHANGING LOAD CONDITIONS on the static pressure in a typical system having a single supply fan are shown here. This system, designed to operate at a static pressure of 4 in. WG, is divided into four equal parts



3 FAN PRESSURE AND SYSTEM RESISTANCE are affected as shown here by changing load conditions. The point at which the fan pressure curve intersects each system resistance curve gives the static pressure at which the fan is operating and the volume of air delivered by the fan at this pressure



4 FAN CAPACITY CONTROL shifts original fan pressure curve downward when load changes. Y' and Z' represent the new static pressures for Conditions Y and Z, respectively



5 FAN PRESSURE AND SYSTEM RESISTANCE CURVES show small shift which occurs for condition Z when fan capacity control is used. The new curves for Condition Z must intersect on line XA

ties. In such cases, fan volume control is often sufficient for handling any load variations that may arise.

Where variations in system load are large, as in exterior zones, fan volume control is not always adequate to insure proper air distribution at the required quantities. The varying loads in exterior zones cause considerable shifts in the air flow path throughout the system. For example, in hot weather near design conditions, most of the air is distributed through the cold duct to take care of the large cooling load, while in cold weather, the hot duct would be used to convey most of the air to the mixing units. In such cases, control of static pressure within the system gives better results than are possible with fan capacity control because static pressure control prevents the pressure from increasing greatly in the duct through which little air is flowing.

Although the fan may be controlled to produce a constant volume of air under different load conditions, the distribution of this air to the numerous mixing units is dependent on the static pressure existing at the valving device of each mixing unit.

Therefore, if a constant static pressure could be maintained at each unit, in addition to controlling the fan capacity at a constant volume, the ultimate in flow control for a double duct system would be reached. This control arrangement may present itself in the future when further developments prove it economically feasible, and experience proves it necessary.

However, this control arrangement can be approached by maintaining a constant static pressure at some point in each main duct. This is accomplished by increasing or diminishing duct resistance by high velocity dampers when the load changes and when a new static pressure at the fan discharge is indicated. Another method is to bypass varying amounts of air back into the fan inlet through a controlled bypass duct. ∓

In the next article on this subject, the author will discuss controlling static pressure in single-fan and double-fan systems, locating static pressure sensing tips by the sampling duct method, and selecting temperature controls.

Question of the Month

Heat Plant with Overhead Pipes?

THE QUESTION, *How Can Overhead Pipes Be Used to Heat Plant?*, was published previously in HPAC and is repeated here for information along with an answer to the question that has been received from one of HPAC's readers. Other comments and answers to the question will also be welcome.

"We are planning to install steam pipes overhead in a new plant, and we would like to know the heating results that may be expected if metal reflectors are installed over the pipes, facing downward. We believe that the radiation from these pipes would probably be appreciable in heating the plant, but we have no evidence of information on the results that may be expected.

"I would be interested in learning from other HPAC readers what experiences they have had with this method of utilizing waste heat." — J.A.R.

SHELDON R. HIGGINS —

"Determine Emission, Consider Heat Loss"

SINCE J.A.R. makes no mention of either steam temperature or pressure, in order to analyze his question and arrive at a reasonable answer we will have to make several assumptions. These are, that the overload steam lines are carrying 125 psig, that these lines are 4 in. steel pipe and that they are about 12 ft above the floor, and that the surrounding air temperature is 50 F.

For our first problem and solution we will assume that the pipes are bare or not insulated for the portion that is under the reflector plates. For both problems we will assume that the pipes and reflector plates are arranged as shown in Fig. 1.

If the reflector plates are within 3 in. of the top of the pipes we can predict the heat emissivity of the reflector plates.

We will also assume that there are 4 in. steam pipes running through the plant as shown in Fig. 1, and that each reflector plate is 10 ft long.

The formula for finding the Btu per hr per sq ft of rated surface for horizontal bare steel pipe is

$$K = [(0.628\,JT_M^3/100^4) + 1]\,(t_s - t_r)$$

Where $J = 1$, and T_M = the temperature of the metal in degrees Fahrenheit, absolute, then

$$T_M = (t_s - t_r)/(2 + 495.6)$$

Substituting in the formula, we find that $K = 1163.5$ Btu per hr per sq ft for bare steel pipe.

By reference to tables in engineering handbooks we find that the value given is 1152 Btu per lineal ft of 4 in. steel pipe. This is near enough for our calculations.

Since we have reflector plates that are 10 ft long and with three pipes under each, then we have a total of 30 ft of pipe per reflector. The total heat emitted from the bare pipe then would be 1152 × 30, or 34,560 Btu per hr.

This is the heat output from the pipe, but this is not all usable heat. There are certain losses to consider.

We must determine the amount of heat transmitted from the pipe to the reflector plate. To do this, it is necessary to derive the heat loss due to conductivity of the air layer between the pipe and the reflector plate.

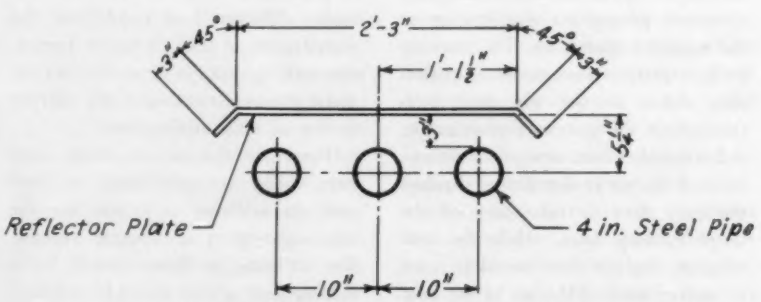
This conductivity is equivalent to 0.168 Btu per hr per sq ft per F deg for a 1 in. thickness. Since our plate is 3 in. above the pipes, then our total conductivity factor becomes three times that figure, or 0.504.

Our heat transfer loss due to the layer of air then would be 0.504 × 303 (the temperature difference between the steam at 125 psig, which is 353 F, and the surrounding air, which is 50 F) × the area of the reflector plate in square feet.

The area of the plate in Fig. 1 is 27.5 sq ft. So, 0.504 × 303 × 27.5 = 4200 Btu per hr loss.

Then, 34,560 − 4200 = 30,360 Btu per hr transmitted to the reflector plate.

If the plate is a highly polished metal surface of a noncorrosive material, then the emissivity factor would be about 0.02, or the reflective value would be about 98 percent. This value would be for new stainless steel or other similar metal kept clean and highly polished. For our purposes,



1 AS A POSSIBLE MEANS to utilize waste heat, a plate is placed above the overhead pipes to reflect the heat downward. The writer tells whether or not such an arrangement is practical

we will assume a lower, more practical reflective value and use 90 percent for calculations. Therefore, 30,360 × 0.90 = 27,324 Btu per hr of heat reflected at the plate.

With the pipes 12 ft above the floor, only about 40 percent of this heat would be effective at the operating level. The available heat from each reflector would be 27,324 × 0.40, or 10,930 Btu per hr.

If the pipes were insulated under the reflector plates, available heat, using the same conditions, would show a loss of 120 Btu per lineal ft. Then, for 30 ft, our pipe would transmit to the reflector plates only 3600 Btu per hr. This would not be enough to be worth considering after deducting all the transmission losses.

I believe that J.A.R. would find this to be a very inefficient and uneconomical method of heating his plant.—SHELDON R. HIGGINS, Mechanical Engineer. ∓

READER ASKS —

"What's Best Way To Heat Monitor Top Building?"

"I would like some help on how to find the best way to successfully heat a monitor top building where a number of workers are on the ground floor.

1) We have tried using a duct from one unit heater which delivers warm air down to the floor. This minimized drafts and the cold layer of air near the floor, but the temperature distribution was not uniform.

2) We have also used a blower in the unit heater without the duct, which forced the warm air down but did not draw the cool air out of the lower level in the areas of the workers.

3) We have some unit heaters at the 8 ft level which discharge warm air horizontally over the working areas, and this arrangement has been fairly satisfactory. However, with this method, there are objections from the workers that the air is sometimes too warm. Also, we have observed that with this method the warm air soon rises into the monitor, leaving the layer of cool air near the floor."—W.H.H.

• *YOU ARE INVITED to contribute a question for publication, or an answer to a published question. Please address your reply to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.*

• *In his question published in the April HPAC, D. L. asked "What Causes Book Pages to Crinkle?" A reply appeared on these pages in September. The following is another answer for the same problem.*

H. B. WAYNE —

"Design for 30 Percent Relative Humidity Best"

FOR BOOKS stored in a library or store, recommended air temperature is between 60 F and 70 F, with relative humidity betwen 38 and 50 percent. The crinkling of book paper results from high moisture content in the air. Book paper is a hygroscopic material having affinity for moisture absorption. The weight of air may comprise as much as 4 percent water vapor at ordinary temperatures. The water vapor in atmospheric air is principally the result of evaporation from the surface of water bodies, the ground, and other objects containing moisture. In addition, moisture is added to the air contained inside buildings from cooking, bathing, and breathing and perspiration from human beings.

When outside air temperature is greater than inside air temperature, the outside vapor pressure is also greater. This pressure head forces moisture into the room, which is condensed when it comes in contact with surfaces having low temperatures. Use of a membrane coating applied to the walls, ceiling, and floor of a room, will help retard the flow of moisture into the conditioned area. The membrane serves as a vapor barrier. For optimum results, it is necessary to have the surfaces to which the membrane is applied smooth, since any distortions will tend to pierce the membrane. Membranes utilizing the vapor barrier principle are classified in accordance with their perm rating. A perm is defined as the passage of one grain of water through 1 sq ft of surface per hr having a pressure differential of 1 in. of mercury.

Since this type of humidity control is usually costly to apply, an absorbent is often used as an alternate. When absorbents are employed for dehumidification, an equilibrium condition is attained whereby the moisture from the hygroscopic material is removed at a nearly constant rate. Thus, the desired relative humidity level is maintained. When additional books are stored with a moisture content greater than that contained by the room air, the humidity value will increase. Under these conditions, the books previously stored in the room will absorb moisture and will retain it until the dehumidifying equipment again catches up with the load. An atmosphere having a relative humidity of 50 percent or less will permit preservation. However, during temperature changes, the relative humidity may rise above the design value temporarily and, therefore, a margin of safety is recommended, in which case design for 30 percent relative humidity is suggested.

Many types of absorbents are available for dehumidification. Some of the common materials are glycerine, sulphuric acid, and calcium or lithium chloride. As liquids, these materials are recirculated by pumps to maintain their absorbing ability. Calcium chloride may be used as a liquid or a solid. Silica or alumina gel are also used. A solid absorbent like the gels generally requires relatively small desiccating chambers and small dryers usually of the cartridge type. The gels can absorb approximately 40 percent of their weight as water and still appear dry. — H. B. WAYNE, Consulting Engineer. ∓

Practical Piping Problems

Providing Flexibility in Piping

. . . is the third fundamental of piping design," says Mac. "Important as other things are, this problem of flexibility causes more concern and trouble than any other factor."

The first two fundamentals, choosing the right piping material and controlling fluid flow, were presented in the July and September 1955 HPAC's, respectively. Others will follow.

By Bill Dopp

WHEN Dave Hawley and Jim Drury returned to Martin MacVane's apartment, he was ready for them. Their previous discussions on the selection of materials for piping systems and the subject of control had laid the foundation for this third fundamental, flexibility. Mac went immediately to the heart of the subject.

"Fellows," he said, "we have come to the most intricate part of this matter of piping design. Important as the other things are, this problem of flexibility causes more concern and frequently much more trouble than any other factor."

Dave said, "I had the idea that everything revolved around control."

"You were thinking only of the control of the fluid in the line," said Mac. But you have to control the line itself. What happens when you heat or cool that line?" he asked.

"It expands or contracts," replied Dave.

"Suppose that your steam line at working temperature is at 1050 F, and you have a shutdown in the winter, and the line temperature drops to 20 below zero. Do you know what the difference in a length of pipe 100 ft long would be under that change of temperature?" Mac asked.

Dave picked up a pencil and paper and did some rapid figuring. "Holy mackerel!" he exclaimed, "That's over 8 in. Does a pipe ever get that cold in a power plant?"

"Perhaps not, Dave," said Mac, "but in designing piping we always have to be prepared for the worst. It's the forethought that prevents trouble. Let's get started."

"All right," agreed Dave, "Where do we start?"

"You Can't Stop Expansion"

"First, we have to agree on some of the facts with which we will become involved," Mac said. "Suppose, for the purpose of discussion, we ignore thermodynamics and agree that heat will be regarded as relative and that expansion and contraction will be considered only in relation to some arbitrarily fixed point in the Fahrenheit scale."

"I don't quite get that," murmured Jim. "Zero is the fixed point in that scale."

"What I mean, Jim, is this," replied Mac. "Let's say that 70 F is the ordinary temperature at which piping is generally erected. Then everything above that would be considered expansion and anything below it would be contraction. That way we have a practical point for figuring temperature rise in our piping structure."

"So you would say that a steam line at 1050 F would be figured as if the actual rise was only 980 F," observed Dave.

"That's right," declared Mac. "Now, if a straight pipe had a temperature rise of that amount, what would happen? It would lengthen, of course. But would that matter?"

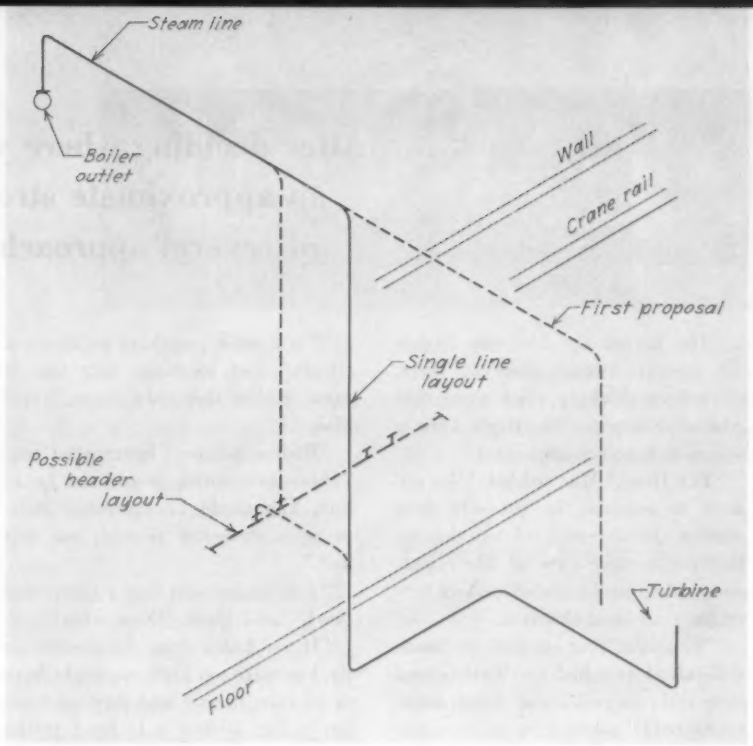
"Not unless you tried to stop it," Dave said. "Then you'd likely have plenty of trouble. You can't stop expansion."

"You can't stop it, Dave, but you can control it. If you respect its dynamic power and understand the effects that are produced when you restrain it, you can have as complete control of it as you do of the fluids in your line."

"Just what are the effects?" asked Jim.

"Strain and stress," replied Mac. "The moment that you apply force

Bill Dopp has had some 40 years of experience dealing with piping, including a long stretch as a sales engineer. He is devoting part of his present leisure to writing of his many piping experiences. All the names used are fictitious.



ALTERNATE PROPOSED LAYOUTS for a 1050 F steam line include the choice of anchoring the header or allowing it to float and permit the forces to find their own balance, thus equalizing the stresses throughout the entire system

to a material—no matter how slight—you produce a strain by deforming or distorting the shape and size of the material. The resistance of the material to change causes stresses to be set up in the material structure. If these stresses get too high, they'll cause permanent deformation of the structure or complete rupture."

"It's true, isn't it, that strain always produces stress and that stress will always produce strain?" asked Dave. "In other words, the two are inseparable. . . . a stress-strain relation?"

"Look for These Stresses"

"Correct," answered Mac. "You may have a variety of both stresses and strains produced by the application of single force such as expansion or contraction. Can you name some of the likely stresses, Jim?"

"Well, you have stresses in tension or compression, sometimes both at once, as when you bend a rod. Then you can have tangential and torsional stresses, too."

"When you are considering piping, Dave, is there any other stress that we have to take into account?"

"Sure," said Dave. "The stresses set up by internal pressure."

"So, when we begin to figure the effects of expansion on piping, we have to take into account all of these, or what we call the combined stresses." said Mac.

"Dave," he asked, "Do you think that you could run your steam line in a straight line directly from the boiler to the turbine?"

"Dave shook his head, "Nope," he replied. "You'd shove the two of them all over the place. There will have to be something between the two to absorb that 8 in. per 100 ft expansion. For 1050 F, expansion joints are out, that's sure."

"That leaves just one way for us to handle the situation," asserted Mac. "We will have to build enough flexibility into the pipe structure to take care of it." He reached for the book lying on the table. "Let's see what the Code for Pressure Piping[1] has to say about this matter. There is considerable discussion of the subject in the code attesting to its importance in piping design. For our immediate purpose, this paragraph will suffice: 'Flexibility shall be provided by changes in direction or by the use of bends, loops, and offsets or provision shall be made to absorb thermal changes by expansion joints of the slip joint or corrugated type.'"

"Where Do You Start?"

Mac winked at Jim and said, "That statement looks innocent enough." Turning to Dave, he asserted, "All you have to do is put in a few bends."

"Not so fast," countered Dave. "That Code also says that there shall be no excessive stresses or bending moments at joints or undesirable forces at anchor points."

"So you know the Code?"

"Of course. We're taught that the Code is the bible of piping designers. There's a provision there, too, that any piping system between anchor points shall be considered as a whole, with all parts subject to flexure and stress. What stumps me is where do you start? Suppose you have a boiler with a side outlet 60 ft above the turbine inlet and the machine is 120 ft from the boiler outlet. You can't just run your pipe horizontal to the turbine and drop a line down to the inlet. There's a wall between and a crane in the turbine room. Both are in the way."

"Then the first thing that has to be taken into account is the physical relation of the pieces of equipment that you intend to connect," said Mac.

"That goes back to the first fundamental, when we were talking about environment," declared Jim.

"In a way it does, Jim," agreed Mac, "but here we are concerned with something other than environment that can affect the material. We have to consider that the various items of equipment are, for all practical purposes, fixed points. Our pipe, too, will have to avoid conflict with other piping, building structure, and restricted space such as the crane freeway that Dave just mentioned."

" . . . After deciding where you want the pipe to go, an approximate stress figure for the layout. of several approaches to figuring flexibility

"The longer the line, the higher the pressure drop," observed Dave. "I've been thinking a lot about that cost of transportation. Right here is where it becomes important."

"Yes, Dave," Mac nodded. "We will have to balance the pressure drop against the necessity of lengthening the line to take care of the expansion and to avoid obstacles. You never have an ideal situation."

"Wouldn't your layout be more difficult if you had two boilers and two turbines with the lines interconnected?" asked Jim.

"That would change the physical situation altogether," declared Mac. "In that case, you would probably have a header, and the boiler side of your line would be, in many respects, a structure independent of the turbine side of the line. If the header were anchored, they would be separate lines as far as the expansion problems are concerned." He made a rough sketch. "Let's take the single line first. Here's your boiler, turbine, and wall. Say it's 50 ft to the wall. How far did you say the turbine outlet would be below the boiler outlet, Dave?"

"Sixty feet," replied Dave. "But you can't run the pipe just above the turbine room floor, so you'd have to add about 10 ft and come at the turbine from below."

What Determines Flexibility?

"All right," consented Mac, "let's say 70 ft and another 70 from the downcomer to the turbine." He drew the line into the sketch. "That is the simplest structure you can get under the circumstances. Now, what will determine its flexibility?"

"The maximum temperature," promptly replied Dave, "and the allowable combined stress under the Code."

"Then we'd just have to figure a simple offset to make sure that it came within the code limits," said Mac.

"Wait a minute," interrupted Jim, "Those two outlets would not be in line. You might have another 20 ft or more crosswise to add into that line."

"That makes our line a compound bend," said Dave. "Now what?"

"If we found that the stresses in the line were too high, we might have to go even further and start up from the boiler, adding a U bend to the structure, too," Mac said.

"That means we might have to figure this line several ways," observed Jim. He pointed to a paragraph in the Code. "But it says here: 'Formal calculations shall be required only where reasonable doubt exists as to the adequate flexibility of the system.' Can you just look at the layout and say, 'That's it' ? "

"No, Jim, that kind of designing doesn't go any more," Mac declared emphatically. "After you've made up your mind where you want the pipe to go, you'll work out an approximate stress figure for the layout. You have your choice of any one of several ways to approach this matter of figuring flexibility in piping." He pointed to the table. "Here are four books. Each one of them sets up a procedure and formula for determining stresses in a piping system under the influence of changes in temperature. If you examine them closely you will discover that, while they're more or less in general agreement on most of the principles involved, they differ considerably in the application of the various factors that affect resistance to flexure and produce stresses in piping systems."

"How come?" asked Jim. I know that if you figure the same problem by two or three of these methods, you will come up with considerably different answers." He shrugged his shoulders. "Which one is right?"

How To Figure Stresses

"They are all right, within limits, Jim. Each one of these methods represents a mammoth amount of experience and research. About 1910, the pressure of steam began to go up and with it, of course, the temperature. While there had been some trouble previously, this was the real beginning of expansion problems."

"Gosh, that's only about 45 years ago," interrupted Dave.

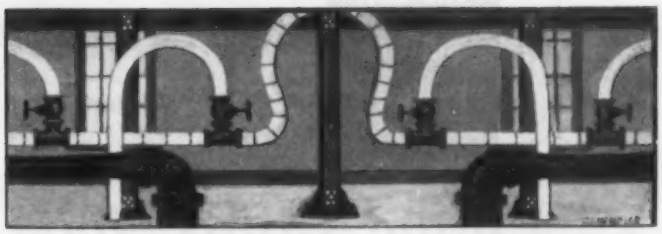
"That's all," said Mac. "About that time experiments were made to determine the flexibility of straight pipe and the common bends then in use. The information was compiled and published in table form. For almost 15 years, this table was the basis upon which all piping was designed. Until trouble began to get serious, the errors in the expansion values were just ignored."

"Do you mean that the table was wrong?" asked Dave.

"Yes, Dave, some of the values were very wrong. For instance the value of a quarter bend when used with a minimum tangent and anchored at both ends just did not exist. Expansion would destroy the pipe joints at both ends of the bend at every temperature rise."

Mac continued, "By 1920, superheated steam had come into rather general use, and we were beginning to get temperatures up to 750 F. About that time, the values in the original table were seriously challenged. It was shown that it was the tangent that gave a quarter bend flexibility and not the curved pipe itself. This started a wave of investigation that is still going on at an accelerated pace."

you'll work out
You have your choice in piping."



"That is saying that the problem of flexibility in piping has not yet been solved," observed Dave.

"You're right, Dave," replied Mac. "As temperatures have increased and new materials have been provided to overcome the adverse effects on material structure, the formula for figuring flexibility has been modified to meet the new situations. Hundreds of thousands of dollars and as many hours of intense study and research have gone into the work. These four books are the result of that effort and, while they do not agree in detail, they all allow ample safety factors, providing a means of reaching safe conclusions about the validity of any piping system to which they are applied.

Mac reached for one of a series of pamphlets.[2] "Recently new studies have been published which summarize what a designer should know about the subject and which provide simpler methods of making the approximations that we first mentioned. If you are going to design piping, it is wise to study everything that is published on the subject."

"Then the thing to do is to figure a system several ways and sort of average the result?" asked Jim.

Usually Adopt One Approach

"That's one way to do it, Jim," Mac agreed. "Usually an engineer will adopt some one method of approach and rely on that, unless he runs into a borderline case. Then he may check by some other method. There are some engineers who refuse to rely entirely upon the analytical methods and build scale models of their proposed lines, using strain gages to determine the stresses under working conditions."

"That's expensive," said Dave.

"Not nearly as expensive as a rupture would be, Dave," said Mac. "No matter how you look at it, there's a lot of expense involved in the proper design of a piping system. Adequate flexibility must be provided. If it is properly determined and the system therefore is never under undue stresses, the expense is of little importance."

"I don't get the reason for this provision in the code for formal calculations," declared Jim. If you have to figure the stresses anyway, why the formality?"

Mac answered, "In demanding formal calculations of the stresses and anchor loads, a client may impose unnecessary expense upon a consulting engineer employed to design the line. That would mean working out all of the stress factors in the system in detail and having them checked and double checked. Such a procedure takes a lot of valuable time. Where the experience of the engineers and the preliminary approximate figures indicate that the system has adequate flexibility, there is nothing to be gained by that added expense."

"Are the designers the sole judges of what they do?" asked Dave. "Isn't there some enforcing body?"

"Many of the states have adopted the Code for Pressure Piping as a part of the requirements for a license to operate a system," said Mac. "The state inspectors thus become enforcing officers, but they are not the only ones who keep designers in line with adequate safety."

"Who else does?" interrupted Jim.

"Almost all piping systems are insured against accident," declared Mac. "The insurance company inspectors are highly qualified engineers, and they keep watchful eyes on the designers and what goes on in the plants. Any doubt in their minds about the flexibility of a system will quickly provoke a demand for the formal figures."

"If we had two boilers and two turbines, you said we would probably have a header. How would that modify the picture?" Jim asked.

Divide Line at Header

"It would, of course, require the dividing of the line at the header, Jim," replied Mac. "You would have a choice of anchoring the header or allowing it to float and permit the forces to find their own balance, thus equalizing the stresses throughout the entire system. Weight here becomes an important factor, as well as the position of the header in relation to other equipment. Everything that may affect the stress patterns must be studied and taken into account."

"It all means that designing piping is not as simple as it looks, doesn't it?" asked Dave.

"Yes, Dave," agreed Mac. "There is another important factor that we have not mentioned. That header of Jim's may play a part in that, too."

"What is that?" asked Dave.

"The flexibility of the system as far as operation is concerned. You realize, of course, that the purpose of the piping is primarily to permit the use of the other equipment. To utilize equipment to the utmost efficiency, the piping must be designed to make the operation highly flexible. Every possible condition that may arise must be foreseen. Adequate provision must be made to prevent the possible shutdown of the plant. Anything overlooked may prove costly."

"That's a matter we'll take up next week," said Mac as he got up to usher the boys to the door. ∓

[1] *Code for Pressure Piping, ASA-B31.1-1951 and ASA-B31.1a 1953, published by The American Society of Mechanical Engineers, and Task Force Report of June 21, 1954.*

[2] *Piping Engineering, Expansion & Flexibility, Papers 4.01, 4.02, and 4.05, prepared by the Tube Turns research staff.*

The Law and Your Profits

By William Hurd Hillyer

Public Utility May Act Privately

. . . says court, ruling that a gas company, though a public utility, may act in its private capacity and therefore owe no duty to persons other than customers

SHARP distinction between a public utility company's relations with its utility customers and with other persons is drawn in a recent court decision. Persons in the heating, piping, and air conditioning field will find the case instructive.

Burma Engineering Co. had for some time been selling and installing space heating equipment which used gas for fuel. Unfortunately, there came a day when the state public service commission, fearing a shortage, issued seven "emergency orders" applicable to High Utilities, Inc., and other concerns furnishing gas to consumers. [All names are fictitious.]

State Limits Gas Service

These orders limited the class of new buildings and additions to existing buildings for which gas heat could be furnished. Ineligible users of gas fired heating systems were required to turn them off. Upon any such user's failure to comply within 10 days, the utility company could furnish him no more gas until the commission's order was complied with and the ineligible equipment removed. Utility companies were also instructed to curtail industrial consumers' gas service, so that domestic consumers might be assured of an adequate supply. Furthermore, it was set forth that "no distributing utility" should be required to supply gas "to any new or prospective consumer for space heating" until he shall have first made written application and obtained the utility company's "written consent and authorization."

Charges Discrimination

Burma complained in court that these rules were enforced against him and his clients but relaxed for his competitors. He made such assertions when he sued High for treble the amount of alleged profits lost by his concern because of lost customers and business. These losses, the heating contractor claimed, resulted directly from High's permitting Burma's competitors to install space heating equipment without having obtained written authority, and from High's "refusal to discontinue furnishing gas to such consumers in violation of emergency gas orders."

"No cause of action," retorted the gas company in court. When that body took a similar view, Burma carried the case to the court of appeals. The higher tribunal's opinion brings out important principles to be borne in mind when dealing, directly or indirectly, with utility companies.

Utility May Act Privately

A heating contractor's hope for a profit from his business, said the court, was not an "interest" intended to be protected by State statute or utility commission's order. The only interest contemplated thereby was that resulting from the consumption of gas. Furthermore, it was held, the fact that a gas company or similar enterprise is, generally speaking, a public utility, does not make its every service a public service. The company may act in a private capacity and, in so doing, is subject to the same rules as a private person or corporation.

The heating contractor in this case had no cause of action against the gas company because that corporation, though a public utility, acted in its private capacity and therefore owed no duty to the heating contractor, the appeals court decided.

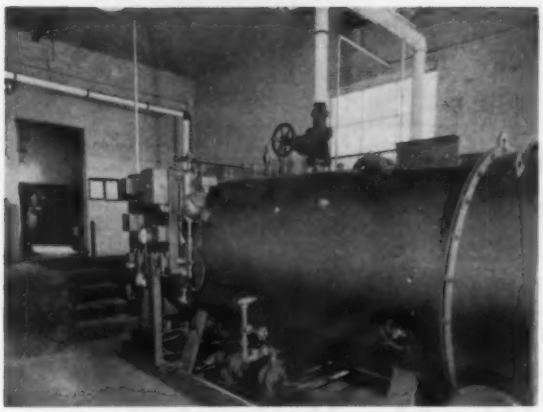
Find No Wrong Against Firm

"Every point of contact between the public and a utility which relates to . . . its public duties is subject to regulation by the State." However, the converse is equally clear. For Burma to have recovered damages from High Utilities, he must have proven that High's violation was "an actionable wrong" against his firm. This he failed to do. There was no contract between him and an existing customer that was interfered with by High; nor did he show that he was prevented by High from signing up any contract for new business. ≠

[Note: While this discussion applies to an actual case, it should be remembered that legal rules vary in different states.]

WILLIAM HURD HILLYER, author of this regular feature, is a contributor to a number of banking and financial publications and has written several books on business. A former vice president of the Atlanta Trust Co., his work there gave him a practical legal background.

On the Job
—notes from the field



SINGLE 100 HP STEAM GENERATOR, oil-gas fired, heats plant and supplies process steam for Lowell, Mass., laundry and cleaning plant. All piping is color coded. Plant is fully air conditioned

CONTROL PROGRAMS for heating, air conditioning, advertising sign, and display lights are checked by Thomas Rinaldi, bar manufacturer

Laundry Cuts Fuel Costs 48 Percent

. . . with new equipment

BY INSTALLING a single high pressure 100 hp packaged steam generator to replace old equipment, Paramount Cleaners and Launderers, Inc., Lowell, Mass., is saving 48 percent in fuel costs, according to York-Shipley, Inc.

For the six month period, the comparative costs for fuel oil are:

Old equipment	$3120.83
New steam generator	1625.41
Saving	$1495.42

Much of the saving comes from the fact that the new steam generator burns No. 5 oil and gas instead of the No. 2 oil that was formerly purchased. The change from oil to gas firing is done automatically, depending on fuel or weather conditions.

Process steam is used both for dry cleaning and in the laundry room to supply one water heater for laundering shirts. The 100 hp generator heats the entire plant. Maximum load is computed to be 78 hp at 2760 lb of steam per hr.

The piping network in the cleaning room is color coded. Steam lines are silver, water lines pink; air lines blue and white striped; rinse lines blue; charge lines yellow; solvent lines white; auxiliary pump lines — through which rinse solvent is pumped to the still or distilled solvent pumped out — green; conduit red. ∓

Plastic Pipe Used for Vinegars by H. J. Heinz Co.

. . . year's operation satisfactory

PLASTIC PIPING plays a major role in transporting vinegars at the Holland, Mich., factory of the H. J. Heinz Co. The plastic piping was installed to replace wooden log lines when the vinegar tank storage facilities were placed in a new location and structure.

Rigid polyvinyl chloride (PVC) is the material used in the pipe and fittings, according to the Colonial Plastics Co., fabricator. The pipe and fittings are made with threaded joints up to 4 in. inclusive, and are also available with flanged joints in 3 and 4 in. sizes.

Installation of the plastic piping and fittings is identical to that used with conventional steel piping. The material is weldable to an extent that facilitates installation in some places. However, T-fittings fabricated by welding proved unsatisfactory. Hangers or supports are spaced at 8 ft.

After a year in operation, no failure has been found from pressures, leakage, or corrosion.

The piping contractor was Vander Walls-Troske, of Holland, Mich. ∓

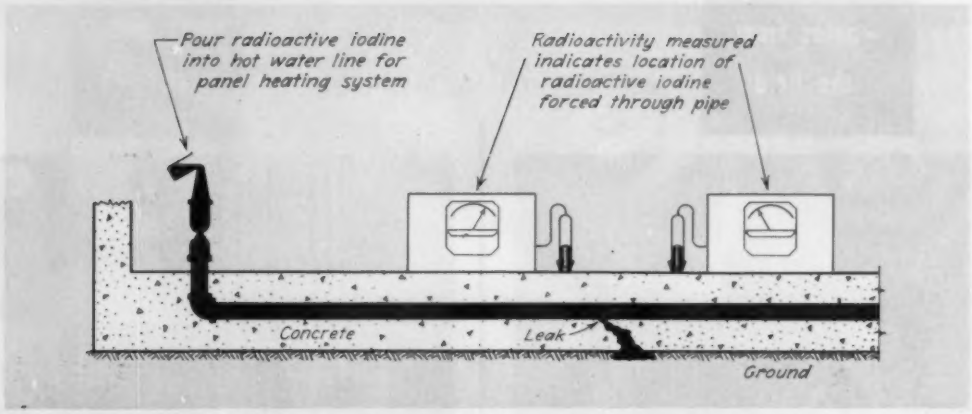
Time Switches Control Heating and Cooling

. . . and neon signs at plant

AUTOMATICALLY timed operation of heating and cooling systems and advertising signs provides efficiency with economy for the Merit Bar & Fixture Manufacturing Corp., of Mount Vernon, N.Y., according to the Tork Clock Co., Inc. Individual control programs are governed by a newly installed group of switches.

All of the switches have a calendar wheel feature. By inserting set screws in the wheel's arms, the owner is able to keep heating or cooling units off on weekends, without altering the master pre-set cycle. The same device keeps display lights and neon signs off on Sundays. The sign switch turns the neon sign on at sunset and off at sunrise every day.

On a single seven-day dial, air conditioning can be programmed on a varying schedule for each day of the week, depending on the needs of changing opening or closing hours. ∓


Pour radioactive iodine into hot water line for panel heating system
Radioactivity measured indicates location of radioactive iodine forced through pipe
Concrete
Leak
Ground

RADIOACTIVE IODINE may be introduced into the hot water line of a panel heating system in order to detect location of suspected leak

Detecting Leaks With Radioisotopes

. . . in piping, other equipment

ONE OF THE ever present problems in the maintenance of industrial heat transfer and other equipment is the detection and location of leaks. Various methods have been successfully used for this purpose, depending upon the nature of the fluids on the two sides of the barrier. For example, in the production of distilled water, the method of electrical conductivity can be used to determine whether the cooling water is leaking into the distilled water. Such a method, however, gives little information if the leak is in the reverse direction. Other methods, depending upon the difference of the properties of the two liquids can be devised. If the leak occurs in equipment which is entirely enclosed, the problem of detection becomes more difficult.

What is a Radioisotope?

A radioisotope is a source of radioactivity. Most people today are familiar with the concept of the atom as a nucleus of protons and neutrons surrounded by a number of electrons revolving in orbits like planets circling a sun. In the case of radioactive atoms, the nucleus of each atom is often pictured as being in an "excited" state, and the action of emission of radiation from the nucleus of such an excited atom is known as radioactivity. This radiation may be either a minute particle of matter or a quantity of energy traveling in a wave form similar to a light ray.

In general, there are three principal types of radiation. These are alpha, beta, and gamma. None of these can be detected by a person's natural senses. The penetrating properties of these three types of radiation, plus the fact that all isotopes of the same atom are chemically identical, make radioisotopes unique tools.

Practical Application Cited

A practical application of the radioisotope method for determining leaks is shown in the accompanying illustration. This particular case involved a basementless structure used as a small commercial establishment with tubes buried in the concrete floor for panel heating. A leak or break in the tubing was suspected since the monthly water bill was approximately $60 and the fuel bill was averaging $400 per month. Attempts to locate the leaks by conventional methods had failed, and it seemed that it was going to be necessary to remove the concrete floor.

Radioactive Iodine Used

A commercial laboratory conceived the idea of adding one to two millicuries of iodine-131 — half life 8 days, beta energy 0.6 and 0.3 mev, gamma energy 0.3 and 0.6 mev — to the water in the heating system. The floor area was explored systematically with a Geiger counter, and the position of the leak was found rather easily because of the large increase of radioactivity resulting from the gamma radiation in the water surrounding the leak. All that was required then was to remove a section of flooring approximately 6 in. in diameter to find the break.

This use of radioisotopes is typical of the manner in which they can be applied in detecting leaks in several types of engineering equipment. The quantities of radioactive material involved are small, and a number of radioisotopes with suitable radiation characteristics and with half life are available for this purpose and such applications. Other applications using radioisotopes are described in a publication entitled *Technical Aids for Small Business*. This booklet is available from the office of the Small Business Administration, Washington 25, D. C.

How To Balance Fan Wheels In the Field

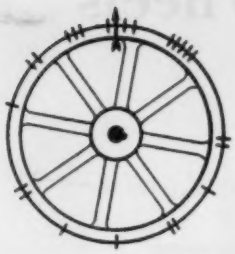
By C. Jack Trickler

Chief Engineer, The New York Blower Co.

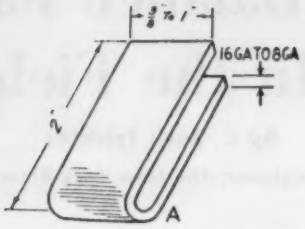
VIBRATION in fans can be induced by many causes. Since rebalancing the wheel cannot stop vibration if any of the causes of vibration are present, these should be eliminated by carefully checking all the following items:

Cause of Vibration	Method of Checking
1) Hopping or bent pulleys 2) Sprung shaft	Hold a rigidly supported pencil or piece of chalk close enough to slowly rotated member to just touch. If line is continuous, pulley or shaft is OK
3) Misalignment of pulleys or couplings	Check with a straight edge
4) Dirt in pulley grooves	Pulley grooves must be smooth and concentric as in (1) above
5) Dirt or lumps on V-belts	Defective belts will have rough joints
6) Dirty fan wheels	If fan is handling dirty air, wheel should be cleaned periodically
7) Unbalanced motor or motor pulleys	Remove V-belt or disconnect coupling and run motor to check for motor vibration
8) Insufficient rigidity of fan platform	Platform must be steady enough to resist sway or give
9) Loose set screws on fan wheel or pulleys 10) Loose foundation bolts 11) Loose bearing bolts 12) Bearings loose on shaft	Tighten all bolts and set screws. Make certain pulley bore is not egg-shaped or over-size
13) Wheel unbalance due to wear	Erosion, corrosion, abrasion
14) Damaged wheel	If wheel is damaged, due to foreign material passing through fan, wheel should be returned to factory for proper repair

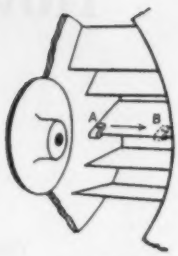
HPAC DATA SHEET



1 MARKS ON PULLEY from typical static balance test. Arrow indicates light point on wheel. Note: 23 marks necessary to establish definite pattern



2 TYPICAL BALANCE WEIGHT, which can be made from available materials. Bend at 'A' such that weight will be a tight fit on wheel blade



3 WEIGHT PLACEMENT is shown close to back plate, A. Moving the weight closer to the front plate, B, as shown by arrow, will often help on particular balance jobs

Vibration occurring after the fan has been in operation for some time, can be due to any of the above, with special emphasis given to items concerning dirt, corrosion, erosion, and abrasion.

All fans should be machine balanced before they leave the factory. Check carefully all items listed, as rebalancing the wheel cannot stop vibration if any of its causes are present.

In nearly all cases of vibration caused by wheel unbalance, field correction of static balance will be sufficient. The instructions given below apply to most types of fan wheels. If in doubt, it is suggested that wheels be returned to the factory for rebalance.

1) Run fan 15 to 20 minutes to loosen bearing grease.

2) Block off the fan inlet or outlet to prevent fan rotation due to stack effect.

3) Number fan blades to keep track of weight placement.

4) Disconnect driving mechanism.

5) Rotate wheel by hand, such that wheel will make at least ten revolutions before stopping. Alternate rotation clockwise and counter-clockwise. Mark at the top of pulley or coupling, each time, the point at which the wheel stops. If stopping points vary considerably in location, continue the operation until a definite pattern develops at some point. (Fig. No. 1). 20 or 30 marks may be necessary to establish a definite pattern.

6) Select a U-shaped weight (Fig. No. 2) and attach at the light point of the wheel, per (Fig. No. 3). If the light point is definitely between two blades, use two small weights, one on each of the adjoining blades. Do not remove any factory installed weights.

7) Remove the pulley marks and proceed again as in (5). If the pattern shows up in the same position, the weight is too light and must be increased. If the pattern is offset from the original position, move the weight or weights around the wheel in the same direction as the offset. Alter weights as necessary and proceed as in (5) above. Continue this procedure until results show no definite pattern.

8) Attach coupling or V-drive and check fan operation. If operation is satisfactory, drill through weight and blade, and rivet or tack weld in position.

9) If vibration is not corrected, then

(a) Static balance is not sufficiently corrected.

(b) Driven sheave is out of balance.

(c) Wheel is badly out of dynamic balance.

Since (c) is the least likely, remove marks on pulley and check static procedure (5) again. If results are consistent, the driven sheave, if of sufficient size, may be out of balance and cause the vibration. Remove the sheave and check as in (5) above, putting marks on end of shaft. If the results are not consistent with those above, the sheave is out of balance and another should be used. It will then be necessary to remove field balance weights and recheck the wheel for static balance.

Achieving Dynamic Balance

Select two equal weights, place one on blade 1 next to the back plate, and the other on blade 7 — opposite blade — next to the front plate, proceeding around the wheel to 2 and 8, then 3 and 9, etc., checking the operation at each point until the best operating position is found. If further improvement is necessary, increase or decrease the weights until performance is satisfactory.

Balancing Fans with Sleeve Bearings

The higher friction coefficient of sleeve bearings makes the foregoing process difficult to apply. In this case, balance can be secured by a cut and try method. Select any blade and attach a weight, running the fan to try for balance, and changing the location around the wheel until the best position is found. Increase or decrease weights to secure the best operation. ⧺

HEATING, PIPING & AIR CONDITIONING
AMERICAN SOCIETY OF
HEATING AND AIR-CONDITIONING ENGINEERS
Journal Section

The object of the Society is to advance the arts and sciences of heating, ventilating, cooling and air conditioning, and the allied arts and sciences, for the benefit of the general public, to encourage and conduct scientific research, and to cooperate with other organizations having the same or similar objectives.

Moisture in Transient Heat Flow

By K. R. Solvason*, Ottawa, Canada

SUMMARY — Measurements were made of the effects of moisture upon the heat flow in simple cases of transient heat flow established under control in laboratory apparatus. Samples of various materials, but mainly of the building insulation type, 7 in. square and up to 2 in. thick were enclosed in a special cell, between hollow plates through which liquid was circulated for heating or cooling. Variation of heat flow with time is shown for various amounts of moisture present and compared to both the experimental and calculated transient conditions for dry materials. Very substantial modifications to the heat flow under transient conditions result from the presence of moisture.

CALCULATION of building heat losses and gains is normally based upon coefficients obtained for dry materials. The presence of moisture, when taken into account, is usually considered to influence the heat transmission by increasing the thermal conductivity. Moisture, according to this simple concept, introduces little additional complication into the calculation of heat flow if it remained stationary within the materials involved. Hutcheon and Paxton[1] have shown that in a hygroscopic material such as wood sawdust the moisture migrates under changing temperature conditions, thus providing a substantial additional mechanism of heat transmission.

Hutcheon and Paxton[1] demonstrated that for wood sawdust, the final redistribution of moisture following imposition of a fixed temperature gradient on the moist sample, could be predicted from the known hygroscopic properties of the sawdust. Following their method the moisture redistribution throughout a sealed sample of sawdust containing 8 percent moisture by weight, has been calculated, and is shown in Fig. 1, for a change from a uniform temperature of 60 F throughout, to 100 F one side and 60 F on the other.

If the sample thickness is 4 in. and the density of dry material is 6 lb per cu ft, approximately 0.022 lb of water per sq ft of sample area must be evaporated in the region from $x/L = 0$ to $x/L = 0.6$, migrate as vapor, and be condensed in the region from $x/L = 0.6$ to $x/L = 1$.

Assuming the latent heat of evaporation to be 1000 Btu per lb, a heat flow of 22 Btu per sq ft across the plane $x/L = 0.6$ results because of the vapor flow.

Once redistributed, the moisture, at least in sawdust, adds little to the heat transfer rate for the dry material. During the redistribution, however, the heat transmission is increased because of the vapor transfer and there is a marked deviation from the conditions for the corresponding case of dry materials.

This mechanism and its effects have now been further examined for several combinations of materials and temperatures.

Tests

Samples of a number of materials, singly and in combination, 7 in. square and of thicknesses up to 2

*Assistant Research Officer, Division of Building Research, National Research Council.

[1]Moisture Migration in a Closed Guarded Hot Plate, by N. B. Hutcheon and J. A. Paxton (ASHVE TRANSACTIONS, Vol. 58, 1952, p. 301).

For presentation at the 62nd Annual Meeting of the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS, Cincinnati, Ohio, January 1956.

in. were inserted between parallel heated and cooled plates. Tests were carried out with the materials dry and then with moisture added. Transient conditions were established by suddenly changing the temperature of one plate, and heat flow rates and temperatures were recorded throughout the test period until conditions had substantially reached steady state.

The materials tested included the following composite and homogeneous samples:

Test No. 1: In this test preformed glass wool was placed between two pieces of fiberboard ½ in. thick and with a density of 15.25 lb per cu ft, or a total weight 1.27 lb per sq ft of area. The glass wool was ⅞ in. thick and had a density of 11.1 lb per cu ft, or a total weight 0.81 lb per sq ft. The moisture contents tested were zero and approximately 5.1 percent of the dry weight of fiberboard or a total of 0.065 lb per sq ft.

Test No. 2: In this test preformed glass wool was placed between two sheets of blotting paper 0.023 in. thick and with density 33.1 lb per cu ft. The total weight of paper was 0.127 lb per sq ft. The glass wool had a thickness of ⅞ in. and a density of 12.4 lb per cu ft. The moisture contents were zero, 0.0325 and 0.065 lb per sq ft.

Test No. 3: In this test the material used was expanded vermiculite, screened through a 13-mesh screen, having a thickness of 1¼ in. and a density of 16.3 lb per cu ft, or a weight of 1.70 lb per sq ft. Moisture contents of zero and 0.065 lb per sq ft of area or 3.8 percent of the dry weight of material were tested.

Test No. 4: The material used was spruce sawdust, 2.156 in. thick having a density of 12.0 lb per cu ft, or a weight of 2.656 lb per sq ft. The moisture contents were zero and 9 percent of the dry weight or 0.194 lb per sq ft of area.

Apparatus and Test Procedure

The testing apparatus developed by Hutcheon and Paxton and modified slightly for these tests, is shown in Fig. 2. It consisted of two 7-in. square hollow aluminum plates between which the test samples were placed. Water at a controlled temperature was circulated through a channel in the plates to produce the desired plate temperatures. Multiple thermocouple bakelite heat meters 4½ in. square by 3/64 in. thick were cemented to the central portions of the plates to measure the heat flows at the boundaries. Strips of bakelite 3/64 in. thick were cemented to the remaining area of the plates surrounding the meters to provide a guard area around the meters. Thermocouples embedded in the plate surface were used to measure plate temperatures.

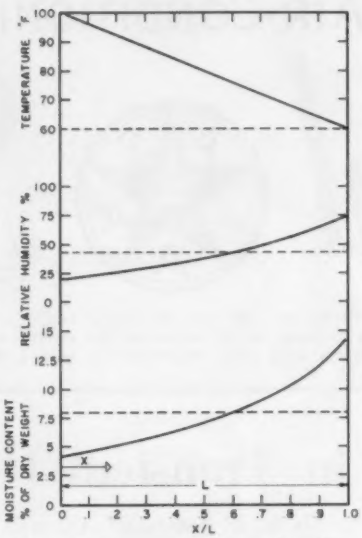


Fig. 1—Temperature, relative humidity, and moisture distribution in wood sawdust with average moisture content of 8 percent for $T_1 = T_2 = 60$ F (broken line) and $T_1 = 100$ F, $T_2 = 60$ F (full line)

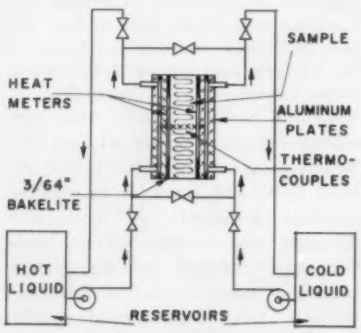


Fig. 2—Testing apparatus — both liquid reservoirs are provided with electronic temperature control

The hot plate temperature was maintained by circulating water from an electrically heated 5-gal reservoir. The cold plate was supplied with water from a refrigerated 60-gal reservoir. A valve arrangement permitted either hot or cold water to be circulated through both plates simultaneously or hot water through one and cold water through the other. Water temperatures had to be accurately controlled since a rapid change in water and plate temperature even though of very small amplitude would cause a large change in the heat meter voltage. A commercial electronic temperature controller was adapted to provide a modulating form of control for both reservoirs.

In tests Nos. 1, 2 and 3, samples with thermocouples spaced at intervals as shown in Fig. 2 were sealed in polyethylene bags and placed between the plates. Cold water (temperature $T_2 = 60$ F approximately) was circulated through both plates until the temperature at all planes reached plate temperature. Hot water (temperature $T_1 = 100$ F approximately) was then substituted for the cold water in the plate at $x = 0$. Starting at the time of the temperature change ($\theta = 0$) readings of the heat meter voltages and of the temperatures were taken at definite time intervals until very nearly steady state conditions prevailed. The electronic temperature indicator used was suitably modified to give heat meter voltages as well as temperatures.

The temperatures T_1 and T_2 were maintained for sufficient time to ensure steady state conditions and the conductance for the dry sample was obtained. The temperature at the plate $x = 0$ was then suddenly reduced to T_2 and heat flows and temperatures again recorded.

With the sample at temperature T_2 throughout, a measured amount of water was introduced near the plate $x = 0$, without disturbing the plate spacing or the sample in any way, and sufficient time was allowed to permit the water to become distributed. The transient heat flow and temperature relationships for the sample were again recorded.

Test No. 4 was performed using an apparatus similar to that used in tests 1, 2 and 3 but with provision to control the plate temperatures from 10 F to 80 F. Heat flow was measured at the $x = 0$ boundary only. The plate temperatures for this test were $T_2 = 41$ F, T_1 in-

creased from 41 F to 79 F; T_1 = 79 F, T_2 increased from 41 F to 79 F; and T_2 = 12 F, T_1 increased from 12 F to 47 F.

Theoretical Heat Flow

The temperature and heat flow relationships following such sudden boundary temperature changes can be expressed by solutions of the Fourier equation:

$$\delta T/\delta\theta = \alpha\ (\delta^2 T/\delta x^2),$$

where

T = temperature (F).
θ = time (hours).
x = distance from the reference boundary (feet).
α = $k/\rho c$, the thermal diffusivity, square feet per hour.
k = thermal conductivity, Btu per (hour) (square foot) (Fahrenheit degrees per foot).
ρ = density, pounds per cubic foot.
c = specific heat, Btu per (pound) (Fahrenheit degree).

If the temperature is initially T_2 at all planes and at time $\theta = 0$ the temperature at $x = 0$ is suddenly increased to T_1, while at $x = L$ the temperature remains at T_2, the temperature is given by:

$$T = T_2 + (T_1 - T_2)\left[1 - x/L - 2\sum_{n=1}^{\infty} \frac{1}{n\pi} e^{-n^2 z\theta} \sin\frac{n\pi x}{L}\right] \quad \text{.....(1)}$$

where

$z = \pi^2\alpha/L^2$.

The heat flow at $x = 0$ will be given by

$$Q_0 = \frac{K}{L}(T_1 - T_2)\left[1 + 2\sum_{n=1}^{\infty} e^{-n^2 z\theta}\right],$$

which can be written

$$Q_0 = Q_S\ [1 + S\ (z\theta)] \quad \text{.....(2)}$$

where

Q_S = the final steady state heat flow which is seen to equal $K/L\ (T_1 - T_2)$.

$S\ (z\theta)$ = the series,

$$2\sum_{n=1}^{\infty} e^{-n^2 z\theta}$$

Similarly at $x = L$ the heat flow will be

$$Q_L = \frac{K}{L}(T_1 - T_2)\left[1 - 2\sum_{n=1}^{\infty}(-1)^{n+1} e^{-n^2 z\theta}\right]$$

or

$$Q_L = Q_S\ [1 - B\ (z\theta)] \quad \text{.....(3)}$$

If after steady state conditions have been attained with temperatures T_1 at $x = 0$ and T_2 at $x = L$, *i.e.* $T = T_2 + (T_1 - T_2)\ (1 - x/L)$, the temperature at $x = 0$ is suddenly reduced to T_2, the temperature and heat flow relations are given by:

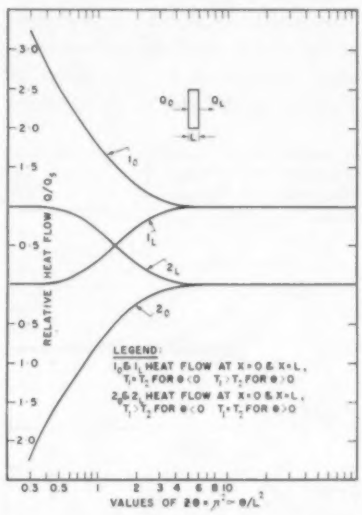


Fig. 3—Theoretical heat flow *vs.* π^2 at/L^2 following sudden temperature changes at $x = 0$

$$T = T_2 + (T_1 - T_2)\left[\sum_{n=1}^{\infty} \frac{2}{n\pi} e^{-n^2 z\theta} \sin\frac{n\pi x}{L}\right] \quad \text{.....(4)}$$

$$Q_0 = -Q_S\ [S\ (z\theta)] \quad \text{.....(5)}$$

$$Q_L = Q_S\ [B\ (z\theta)] \quad \text{.....(6)}$$

where

Q_S = the steady state heat flow before time $\theta = 0$.

$S\ (z\theta)$ and $B\ (z\theta)$ = the series as in Equations 2 and 3.

Typical values of Q_0/Q_S and Q_L/Q_S, which will hereinafter be referred to as the relative heat flows, are plotted against ($z\theta = \pi^2\alpha\theta/L^2$ in Fig. 3, using calculated values of $S\ (z\theta)$ and tables of $B\ (z\theta)$.

Experimental heat flow values may deviate from the theoretical values due to departure from unidirectional heat flow and to the finite time required to produce a boundary temperature change.

The equations may, however, be used as a check on experimental values for dry materials and as a basis of comparison for the corresponding observations with moist materials. They may also be used to examine the extent to which the case with moisture present may be represented by the case for the dry material with adjustments to the coefficients.

Discussion of Results

The relative heat flows Q_0/Q_S and Q_L/Q_S (Q_S = the steady state heat flow for dry material) are presented graphically in Figs. 4, 5, 6 and 7, for tests Nos. 1, 2, 3 and 4 respectively. The temperature rise with time at various planes in test No. 2 is shown in Fig. 8. A logarithmic time scale is used, in all cases, as a convenient base for plotting.

The presence of moisture, as was expected, very markedly increased the transient heat flows occurring when T_1 at $x = 0$ was increased. An increase in heat flow occurred not only at the $x = 0$ boundary but also at the $x = L$ boundary. Maximum relative heat flows Q_L/Q_S of 1.4 (Fig. 4), 2.6 (Fig. 5) and 1.3 (Fig. 6) were observed in tests 1, 2 and 3 respectively. These values, according to the theory for dry materials, (Equation 3) should have approached but not exceeded the final steady state values of 1.05, 1.02 and 1.025 respectively which were found with moisture present.

The time required to reach a given value of Q_L/Q_S was considerably reduced with moisture present. Comparative times, for example, to reach Q_L/Q_S = 0.9 were 27/44, 3.5/16 and 15/19 for tests Nos. 1, 2 and 3 respectively.

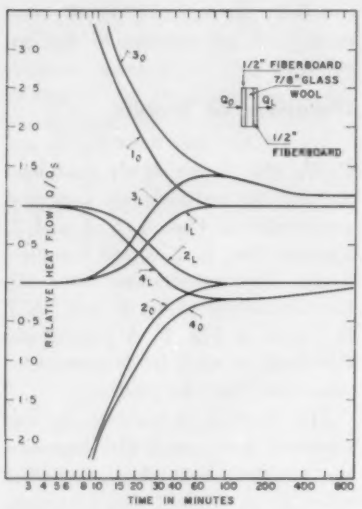
It may be noted that the results just presented for the case of an increase in T_1 from 60 F to 100 F, T_2 remaining at 60 F, are for the first such operation, following introduction of the water near the $x = 0$ plate. The corresponding curves obtained for subsequent cycles produced by reducing T_1 to 60 F and then increasing to 100 F a second time did not show exactly the same moisture effects as the initial curves. The in-

fluence of moisture was generally less. The moisture, introduced near $x = 0$, although given some considerable time to seek a uniform distribution was prevented from reaching this condition because of the hysteresis effect in adsorption and desorption, so that the first operation following addition of the water always began with a higher moisture content near the $x = 0$ side.

The curves presented show the instantaneous rates of heat flow. It is of interest also to consider the effect of moisture in terms of the total additional heat transmitted in a given period. This can be found from the area between the curves for the wet condition and that for the dry test. The cumulative increase in heat flows at the $x = L$ plate, for various times after increase of T_1, are given in Table 1 for the case of T_1 increased from 60 F to 100 F. The results for test No. 4 with sawdust are not included since heat flow was metered only at $x = 0$.

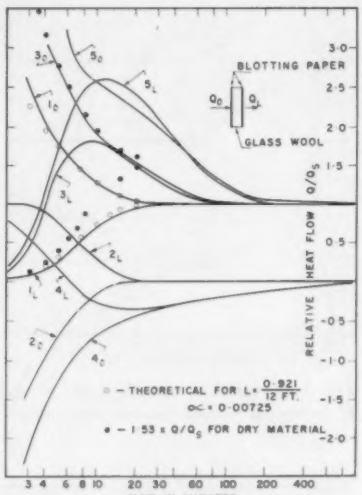
It may be noted that the corresponding latent heat transmission, if all the water were evaporated at $x = 0$, moved as vapor and condensed at $x = L$, would be 32 and 65 Btu for the two moisture contents. The increased heat flow at the end of 6 hr varied from 16 percent of this latent heat value for test No. 1 with the fiberboard and glass wool sample to 47 percent in test No. 2 for the blotting paper and glass wool sample. However, in test No. 1 the cumulative increase in heat flow was still growing and at the end of 20 hr had amounted to 36 percent of the latent heat value.

The effects of moisture on the heat flows in the cases in which the temperature T_1 at the $x = 0$ boundary was reduced from 100 F to 60 F, T_2 at $x = L$ remaining constant at 60 F, were of the same order as those occurring upon an increase in T_1 from 60 F to 100 F as just discussed. The heat flow *out* at $x = 0$ following a decrease of T_1 was increased by the presence of moisture. The heat flow *out* at $x = L$, which in the dry case decreased gradually from the steady state value to zero, was caused by the presence of moisture to decrease much more rapidly, then to



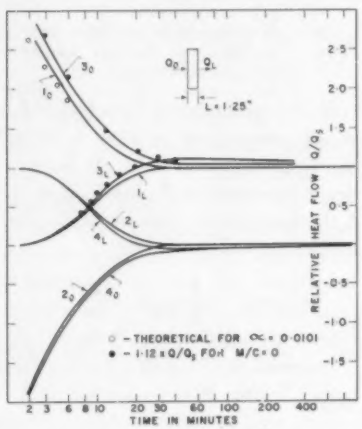
Legend
1₀ & 1L: M/C = 0
3₀ & 3L: M/C = 0.065 lb/ft²
T_2 = 60F T_1 increased 60F to 100F at $\theta = 0$
2₀ & 2L: M/C = 0
4₀ & 4L: M/C = 0.065 lb/ft²
T_2 = 60F T_1 decreased 100F to 60F at $\theta = 0$
Final Q/Q_S for 3₀ & 3L = 1.05
Q_S = 6.72 Btu/hr for ΔT = 40F

Fig. 4—Heat flow *vs.* time for glass wool and fiberboard combination following sudden boundary temperature changes (test No. 1)


BLOTTING PAPER
GLASS WOOL
○ – THEORETICAL FOR L = 0.921/12 FT.
α = 0.00725
● – 1.53 x Q/Q_S FOR DRY MATERIAL
RELATIVE HEAT FLOW Q/Q_S
TIME IN MINUTES

Legend
1₀ & 1L: M/C = 0
3₀ & 3L: M/C = 0.0325 lb/ft²
5₀ & 5L: M/C = 0.065 lb/ft²
T_2 = 60F T_1 increased 60F to 100F at $\theta = 0$
2₀ & 2L: M/C = 0
4₀ & 4L: M/C = 0.065 lb/ft²
T_2 = 60F T_1 decreased 100F to 60F at $\theta = 0$
Final Q/Q_S for 5₀ & 5L = 1.02
Q = 10.8 Btu/hr for ΔT = 40F

Fig. 5—Heat flow *vs.* time for glass wool and blotting paper combination following sudden boundary temperature changes (test No. 2). L = 0.921 in./12 ft



Legend
1₀ & 1L: M/C = 0
3₀ & 3L: M/C = 0.065 lb/ft²
T_2 = 60F T_1 increased 60F to 100F at $\theta = 0$
2₀ & 2L: M/C = 0
4₀ & 4L: M/C = 0.065 lb/ft²
T_2 = 60F T_1 decreased 100F to 60F at $\theta = 0$
Final Q/Q_S for 3₀ & 3L = 1.025
Q = 15.2 Btu/hr for ΔT = 40F

Fig. 6—Heat flow *vs.* time for expanded vermiculite following sudden boundary temperature changes (test No. 3)

Table 1—Increase in Heat Flow in Btu at the $x = 0$ Plate at Various Times Following an Increase in T_1 from 60 to 100 F

Test No.	Moisture content lb/sq ft	Time from increase of T_1 (hr)					Increase at 6 hr in % of latent heat value
		0.5	1	3	6	20	
1. Fiberboard and glass wool	0.065	0.5	1.7	6.2	10.6	23.7	16
2. Blotting paper and glass wool	0.032	6.9	9.6	12.0	13.0	13.9	43
	0.065	9.2	15.6	24.7	27.9	30.4	47
3. Expanded vermiculite	0.065	0.64	5.8	9.1	12.7	24.6	38

become zero and to be followed by a heat flow *in* which reached a maximum value and then reduced to zero. The heat flow *in* reached values of Q_L/Q_s of 0.21, 0.34 and 0.05 for tests Nos. 1, 2, and 3 respectively.

rise to the first maximum indicates condensation which is followed by a temperature drop indicating re-evaporation and finally a slow rise approaching the value for the dry material as the evaporation is completed. The amount of moisture present in this test was more than could be absorbed hygroscopically, leading to rather high humidities, so that this effect was more pronounced than would normally be expected.

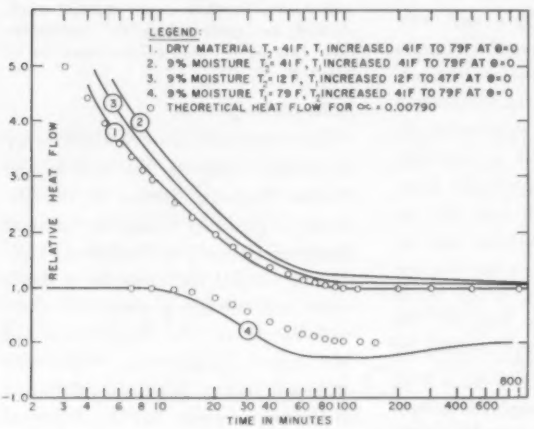

LEGEND:
1. DRY MATERIAL T2 = 41 F, T1 INCREASED 41F TO 79F AT θ=0
2. 9% MOISTURE T2 = 41 F, T1 INCREASED 41F TO 79F AT θ=0
3. 9% MOISTURE T2 = 12 F, T1 INCREASED 12F TO 47F AT θ=0
4. 9% MOISTURE T2 = 79 F, T1 INCREASED 41F TO 79F AT θ=0
THEORETICAL HEAT FLOW FOR α = 0.00790
RELATIVE HEAT FLOW
TIME IN MINUTES

Fig. 7—Heat flow *vs.* time for spruce sawdust following sudden boundary temperature changes (test No. 4)

During the transient period, the net heat flow *out* at both sides must always equal the difference in heat stored in the material between initial and final conditions. Without moisture present, heat flowed out at both sides, gradually reducing to zero as temperatures equalize. However, with moisture present, which was redistributed by a process of evaporation, vapor flow and condensation as the temperatures equalized, heat had to be provided for the evaporation and absorbed upon condensation. The heat of evaporation was supplied partly from the plate at $x = L$ and partly by conduction from the condensing region. The balance of the heat liberated upon condensation moved by conduction to the plate at $x = 0$. The heat required for evaporation was first drawn from the sensible heat in the material, but as the evaporation continued, the temperature was reduced below 60 F, resulting in a heat flow *in* at $x = L$.

During the redistribution, moisture evaporated at one plane need not necessarily migrate to another plane and remain there, but may successively be condensed and re-evaporated at several intermediate planes. This phenomenon is illustrated by the temperature curves for test No. 2 (Fig. 8). The rapid temperature

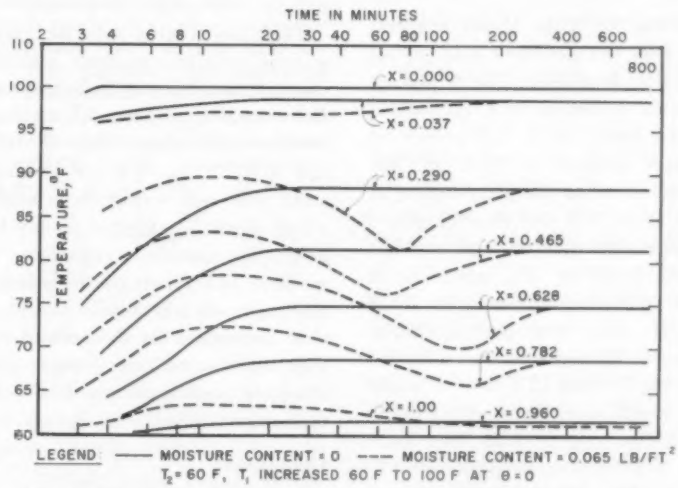

TIME IN MINUTES
X = 0.000
X = 0.037
X = 0.290
X = 0.465
X = 0.628
X = 0.782
X = 1.00
X = 0.960
TEMPERATURE, °F
LEGEND: —— MOISTURE CONTENT = 0 ---- MOISTURE CONTENT = 0.065 LB/FT²
T2 = 60 F, T1 INCREASED 60 F TO 100 F AT θ = 0

Fig. 8—Temperature rise *vs.* time at various planes for glass wool blotting paper combination (test No. 2)

A mathematical treatment of the case with moisture present would be complicated since the conductive heat flow and the latent heat flow are so inter-related. The latent heat flow must operate both in series and in parallel with the conductive heat flow, since heat must flow by conduction to the plane at which water is being evaporated, be transported in the vapor to the plane at which water is being condensed and again flow by conduction to the cold boundary. Thus, in effect, the heat flow can bypass the thermal resistance between the evaporating and condensing regions.

During part of the transient with moisture present the heat flow at $x = 0$, appears, in some of the tests, to be a constant multiple of the heat flow for the dry material. Points have been plotted in Figs. 5 and 6 showing 1.53 and 1.12 times the heat flow for the dry material. These agree fairly closely with heat flow for the moist material for the time from $\theta = 0$ until steady state conditions were reached with the dry material. The $x = 0$ heat flow with moisture can be represented approximately by equation 2 using a lower value for α. This device does not, however, usefully describe the heat flow at $x = L$ since Q_L/Q_s (Equation 3) can still only equal unity, while in the actual case a value greater than unity is found.

While no simple correlation between heat flow and moisture movement is evident, the magnitude of the increase in heat flow observed in the

tests with moisture does indicate some of the factors involved.

The larger of the two moisture contents in test No. 2 is seen to produce a much larger increase in heat flow.

Comparing tests Nos. 1 and 2, with equal total amounts of moisture, a much greater increase in heat flow resulted in test No. 2. This can be attributed to the lower thermal resistance between the heat source and the moisture source and also between the moisture sink and the heat sink.

The expanded vermiculite (test No. 3) exhibited a relatively smaller increase in heat flow. It is thought that the water present was more intimately bound in this material and permitted a much lower rate of evaporation.

In test No. 4 the higher temperature level test produced a larger increase in heat flow. The 9 percent moisture content at 41 F indicates a relative humidity of 47.5 percent or a vapor pressure of 0.122 in. Hg. Upon increasing the temperature at $x = 0$ to 79 F the vapor pressure could rise momentarily to approximately 0.500 in. Hg, producing a vapor pressure difference of 0.378 in. Hg. The corresponding vapor pressure difference produced by increasing T_1 from 12 F to 47 F would only be 0.124 in. Hg, resulting in the smaller increase in heat flow. Tests at a 20 F temperature difference ($T_1 = 60$, $T_2 = 40$ not shown here) produced practically the same relative heat flow as a 40 deg temperature difference ($T_1 = 80$, $T_2 = 40$). With one-half the temperature difference, very nearly one-half the initial vapor pressure difference results and hence the same relative heat flows.

Since a vapor flow is necessary to produce the increased heat flows illustrated, the vapor permeability of the materials can be expected to have a marked influence on the increase in heat flow.

The transient conditions selected for study were chosen to facilitate the testing. They do, however, give some indication of the probable importance of moisture in cases of periodic heat flow such as are involved in the determination of air-conditioning loads from walls and roofs. In these studies the temperature changes were created suddenly while in periodic heat flow they occur gradually. The rapid and substantial increase in heat transmission attributable to the presence of moisture in certain of the transient cases indicates that similar substantial effects may be expected in periodic flow. The maximum periodic flow, the total flow or both may be increased. Since the moisture may be regarded as providing a mechanism which can, by providing for latent heat transfer, by-pass part of the resistance to conduction provided by a vapor permeable insulation, it may be expected also that in certain cases the time lag for maximum heat flow will be substantially decreased.

The cases studied were for closed systems, whereas in walls moisture can enter and leave at the boundaries. However, the amounts of moisture introduced in these tests of 0.032 and 0.065 lb per sq ft are relatively small and well within the amounts which might be expected in any hygroscopic materials regardless of moisture transfer at the boundaries. Built-up roofs will usually provide a close approximation to a closed system and may at times contain considerably greater quantities of water than those studied.

Conclusion

It has been shown that moderate amounts of moisture present in porous samples capable of providing moisture storage can modify greatly the transient heat flow conditions from those found for corresponding dry samples. Temperature changes produced corresponding vapor pressure changes and led to evaporation, vapor flow, and condensation. This constituted an additional mechanism for the transmission of heat in the form of latent heat, operating in conjunction with the usual mechanisms of heat transmission in dry materials. The effect of the moisture upon the steady state heat transmission in the samples studied was shown to be small.

The magnitude of the variation in the heat flow pattern produced by the presence of moisture in an actual wall or roof construction would appear to depend on: (*a*) the amount of moisture present; (*b*) the imposed temperatures and vapor pressures; (*c*) the moisture-sorbing and moisture transmission properties of the materials; and (*d*) the heat transmission properties of the materials and the arrangement of the materials.

The results indicate that substantial effects may also be found in many cases of periodic heat flow in walls and roofs. Further experimental work should be undertaken to determine how extensive these effects may be in practice.

Acknowledgment

The experimental work was done by the author while on the staff of the Prairie Regional Station of the Division of Building Research, National Research Council, at Saskatoon, Canada. It formed the basis for a thesis submitted, under a cooperative arrangement, to the Department of Mechanical Engineering, University of Saskatchewan, in partial fulfillment of the requirements for the degree of Master of Science. The author is indebted to members of the staff of the College of Engineering of the University of Saskatchewan, to N. B. Hutcheon, assistant director of the Division of Building Research, and to G. O. Handegord, officer-in-charge of the Prairie Regional Station, for assistance and encouragement in the prosecution of this project.

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ASRE TO MEET IN ATLANTIC CITY

The 51st Annual Meeting of *ASRE* is to be held December 1-3 at the Traymore Hotel in Atlantic City. It has been announced that the program will include three technical conferences and six technical forums as well as a research exhibit.

CORNELL SCHOLARSHIP HONORS DR. CARRIER

It has been announced by Carrier Corp., Syracuse, N. Y., that a scholarship at the Cornell Sibley School of Mechanical Engineering has been established. The scholarship is named in honor of Dr. Willis H. Carrier, founder of the company and a long-time member and past president of the Society. Dr. Carrier was himself a graduate of Cornell University and served as an alumni trustee.

The grant is part of a scholarship program undertaken to honor both Dr. Carrier and J. Irvine Lyle, also a long-time member and past president of the Society.

Electrical Analogger Analysis of a Cooled-Structure Complex

By Carl F. Kayan*, New York, N. Y.

AIR-CONDITIONED structures, or buildings maintained below atmospheric temperatures, represent a composite arrangement in which the inward flow of heat through the structure along with heat from other sources must ultimately be absorbed by some cooling medium within the conditioned space.

Absorption of the thermal loads is generally brought about through a conventional refrigerating plant wherein the heat flow to the structure is accounted for in the condenser, along with the refrigerating work of energy transport in the compressor or heat pump machine.

The present analysis is devoted to the development of a method for predicting the overall performance characteristics of a cooled structure with an integrated refrigeration plant including its attendant heat-transfer equipment. This analysis covers the total process-complex applying electrical Analogger methods to the entire combined thermal circuit.

The performance prediction of a separate composite vapor-compression plant is difficult because of the many simultaneous variables acting. The design may be based on initially set conditions, but during operation the conditions may be quite different. A plant with a fixed compressor size, designed to chill a fluid at a specified initial temperature and flow rate, may operate with fluid at a different temperature. The same might be said of the heat rejection process in the condenser. If the temperature of the fluid (such as air to be cooled by the refrigerating plant) is considered the result of energy flow within a thermal structure, then the problem is further magnified. Under these circumstances, prediction of the performance of the entire cooled-structure complex, as involving the plant components of fixed dimensions, may be quite difficult. Particularly is this so if transient heat transfer enters into the problem, and if performance *vs.* time is desired.

SUMMARY — A method is described for predicting the overall performance characteristics of a cooled structure with an integral refrigeration plant for air conditioning and attendant heat-transfer equipment. The prediction is made by an electrical analogue and the electric circuits for this purpose are analyzed and diagrammed. Equations are presented for making the necessary calculations and the method is applied to an illustrative example.

Performance under varying operating conditions may be investigated by means of the resistance concept utilized in heat-transfer studies. Specifically, in addition, the interdependent relationships for the several system components may be investigated by electrical analogy methods with thermal values represented by electrical quantities. Application of the resistance concept and use of electrical analogy methods for the study of different steady-state thermal-circuit systems is well recognized[1,2,3,4,5], and likewise so for unsteady-state systems[6]. Extension of the resistance concept to include refrigerating machine performance as coupled with heat-transfer equipment has been reported on,[7,8] and although inherently a part of the present cooled-structure-complex analysis, will not be repeated here in detail.

Refrigerating Plant Performance

The basic refrigerating-plant components are: (1) vapor compressor, (2) refrigerant condenser, (3) expansion valve (pressure-drop device), (4) refrigerant evaporator (direct-expansion cooling coils in the present analysis). Each component has operating characteristics which depend not only on its design, but also on the working conditions. Of prime importance in the performance of a reciprocating compressor, operating with a given refrigerant and a given rate, is the real volumetric efficiency. This, along with the low pressure conditions, governs the amount of realized refrigerating capacity. The volumetric efficiency[7,8] depends on a number of items, including clearance, nature of the gas, pressure-difference ratio, and valve pressure drops.

Typical variations of energy rates in the *heat-pump* operation of a refrigerating plant are shown in Fig. 1, as a function of the equivalent temperature difference represented by the overall difference in pressure between the evaporator and the condenser.

Ultimately, all the energy delivered at the condensing pressure and temperature must be given up in the condenser. Then the necessary condensing temperature with respect to the coolant conditions of inlet temperature and flow rate, coupled with the overall heat-transfer *coefficient* and

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[1]Exponent numerals refer to References.

surface area, will provide for the absorption of this energy[7,8].

The energy absorbed at the low-temperature level, under the refrigerant evaporating conditions, must in effect be transported to the condensing level of temperature. Just as the resistance concept has been extended to cover heat-exchanger energy flow via the overall temperature difference[5], so has it been further extended

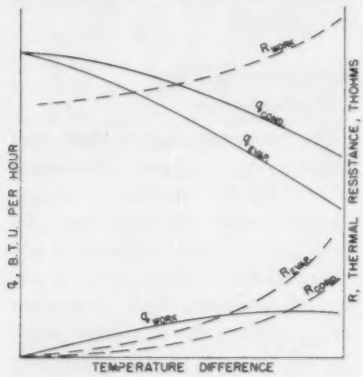

Fig. 1—Typical variations of energy flow rates and corresponding resistances as a function of temperature difference, for a vapor compression refrigerating plant

recently to cover energy flow in a machine[7,8]. Equivalent resistance values are used to represent compressor performance between equivalent temperature (pressure) levels. With the variation of compressor performance expressible in terms of overall temperature difference, the resistance values for the compressor energy may be obtained by dividing the temperature difference by the hourly heat quantities:

$$R = \Delta t/q \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

where

R, the resistance value, may refer to the hourly heat for the evaporator (*i.e.* direct-expansion cooler), thus R_{evap}; hourly condenser heat, R_{cond}; or hourly compressor-work energy, R_{work}.

Typical resistance values corresponding to the energy values just indicated are shown in Fig. 1.

Heat Load of the Cooled Structure

As noted, the cooled-structure load may consist of: (1) heat transfer through the walls[1,2,3] as based on the temperature difference between outside and inside, inclusive of surface

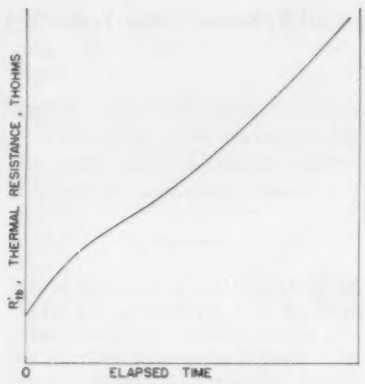

Fig. 2—Typical variation of transient body resistance as a function of time

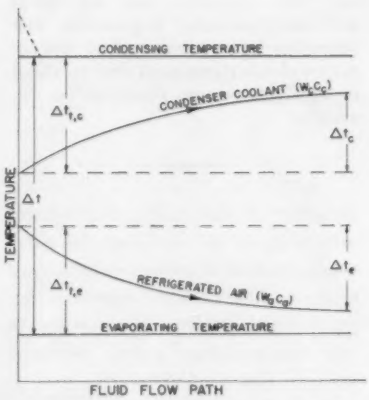

Fig. 3—Typical temperature curves for refrigerating plant heat transfer equipment

effects, and to which may be coupled ventilation or infiltration air-cooling effect; (2) internal heat release from equipment such as lights and power; and (3) heat given off by *hot* bodies brought in from outside temperature and thus released transiently as the bodies are cooled to space temperature.

The wall heat transfer, plus the air (infiltration) cooling effect when considered together on a total hourly basis, may be represented through the structure temperature difference $\triangle t_w$ by means of an equivalent resistance R_w:

$$q_w = \Delta t_w/R_w \quad \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Thus, the amount of heat flowing in, under steady-state conditions, is dependent on the temperature difference, and by the nature of the structure boundary walls and their surface effects, their total area, and by the nature and amount of the incoming air.

Internally released heat is usually independent of the maintained tem-

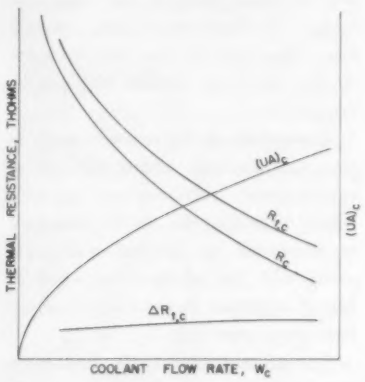

Fig. 4—Typical variation of condenser resistance, and "UA" values, as a function of flow rate

perature difference, and hence is accounted for separately in the total of heat acquired within the conditioned enclosure, which has ultimately to be dissipated to the refrigerating plant. This is separately handled in the subsequent electrical Analogger approach.

When a hot solid body is suddenly exposed to a cool fluid (such as air) at its surface, the heat transfer effects are transient and progressive. The temperature at the surface and at different points within the body change with time at a rate dependent on heat-transfer properties of the body and of the fluid at the surface.

The following expression, from Schack[9], satisfactorily represents the relationship for the surface temperature t_s of a hot body, originally at a uniform hot temperature t_{ex}, suddenly exposed continuously to a cold fluid at temperature t_a and for which a surface coefficient h_s may be applied:

$$t_s = t_a + (t_{ex} - t_a)\ (f_s). \ldots (3)$$

where f_3 is a specially defined function value depending on the material properties, the time elapsed after the initiation of exposure, and the surface coefficient (boundary conductance). Thus

$$(t_s - t_n) = (t_{ex} - t_n)\ (f_3) \quad \ldots(4)$$

The rate at which the surface will give up heat, based on its temperature difference vs. the surrounding fluid, will be:

$$q = Ah_a\ (t_s - t_n) = Ah_a\ (t_{ex} - t_n)\ (f_3) \quad \ldots\ldots(5)$$

$$q/A = h_a\ (f_3)\ (t_{ex} - t_n) = (t_{ex} - t_n)/(R'_{tb}) \quad \ldots(5a)$$

Hence the transient-body resistance of the material, R'_{tb} (per square foot) or R_{tb} (for the gross exposed area — A), will depend on time and physical properties, and be related to the original temperature difference:

$$R'_{tb} = 1/(h_a f_3) \quad \ldots\ldots\ldots\ldots(6)$$

$$R_{tb} = 1/(Ah_a f_3) \quad \ldots\ldots\ldots\ldots(6a)$$

The typical variation for the transient-body resistance (per square foot), R'_{tb}, in accordance with Equation 6†, is shown in Fig. 2.

Heat Exchanger Relationships

Both the condenser and the evaporator (direct-expansion cooler) involve, in the ideal, constant temperature conditions with respect to the refrigerant (condensing or evaporating). Sensible heat with changing temperatures prevails with respect to the corresponding circulating fluids, *i.e.*, condenser coolant or evaporator fluid. Typical heat exchange curves for these equipments are shown, combined in Fig. 3.

The flow of heat in the condenser may be considered to vary with the overall temperature difference between the saturation condensing temperature and the incoming coolant temperature, with the effect of compression superheat on condenser performance neglected. The hourly condenser-heat flow, as given in a previous paper[5], may be shown in terms of resistance:

$$q_c = \Delta t_{t,c}/R_{t,c} \quad \ldots\ldots\ldots\ldots(7)$$

$$R_{t,c} = R_c/(1 - 1/e^{R_c/R_{UA,c}}) \quad \ldots\ldots\ldots(8)$$

$$R_c = 1/(W_c c_c) \quad \ldots\ldots\ldots\ldots(9)$$

$$\Delta R_{t,c} = R_{t,c} - R_c \quad \ldots\ldots\ldots\ldots(10)$$

These relationships are depicted on a general basis in Fig. 4, plotted against coolant flow rate, W_c.

Similar equations apply to the direct-expansion cooler (evaporator), for the general temperature relationships shown in Fig. 3:

$$q_e = \Delta t_{t,e}/R_{t,e} \quad \ldots\ldots\ldots\ldots(11)$$

$$R_{t,e} = R_a/(1 - 1/e^{R_a/R_{UA,e}}) \quad \ldots\ldots\ldots(12)$$

$$R_a = 1/(W_a c_a) \quad \ldots\ldots\ldots\ldots(13)$$

$$\Delta R_{t,e} = R_{t,e} - R_a \quad \ldots\ldots\ldots\ldots(14)$$

Since these equations are similar to those of the condenser, Fig. 4 may be considered to typically represent them also.

Structure-Complex Performance Characteristics via Electrical Analogger

The thermal energies acquired in the structure must ultimately be taken up by the refrigerant, and dissipated, along with machine work, in the condenser. These structure energies flow into the system via the evaporator (direct-expansion cooler). They thus enter the system as a given fluid weight-flow-rate cooling through the requisite temperature difference. They may be considered to enter the cooling system at the temperature that corresponds to the space-system equilibrium conditions. This means equilibrium between entering-structure energy and evaporator-extracted energy. As just shown, the different energy flow rates may be defined in terms of resistances and resultant temperature differences.

The different energy resistances are interrelated in the overall process complex. They may thus be represented together in a thermal-energy circuit of energy flow in the structure, in the evaporator, and in the condenser, as well as the energy transport in the compressor.

For practical manipulations, translation from thermal to electrical circuit values proves advantageous.

The electrical analogger circuit may be constructed to facilitate the performance evaluation of the overall structure-complex, including the refrigerating plant. Herein electrical resistance values, proportional to those set by the preceding thermal equations, are employed, with electrical

Nomenclature

A = heat transfer surface area, square feet.
c_a = evaporator air flow specific heat, Btu per (pound) (Fahrenheit degree).
c_b = transient body specific heat, Btu per (pound) (Fahrenheit degree).
c_c = condenser coolant mean specific heat, Btu per (pound) (Fahrenheit degree).
a = thermal diffusivity, $= k/(\rho c_b)$.
f_3 = function of $4a\theta/L^2$ and $h_a L/(2k)$.
h_a = boundary conductance of air (heat transfer), Btu per (sq ft) (Fahrenheit degree) (hour).
L = thickness of transient solid body, feet.
k = transient body thermal conductivity, Btu per (square foot) (hr) (Fahrenheit degree per foot).
ρ = density, pounds per cubic foot.
θ = time elapsed, hours.
q = heat energy as applied to different elements of system, Btu per hour and identified by subscripts, such as in conjunction with compressor, *i.e. work*, *evap*, and *cond*.
R_c = condenser-coolant heat-exchange resistance, thohms, Fahrenheit degree per (Btu) (hour).
R_a = evaporator-air-flow heat exchange resistance, thohms, Fahrenheit degree per (Btu) (hour).
$R_{t,c}$ = total equivalent thermal resistance for condenser, thohms, Fahrenheit degree per (Btu) (hour).
$R_{t,e}$ = total equivalent thermal resistance for evaporator (air cooler), thohms, Fahrenheit degree per (Btu) (hour).
$R_{UA,c}$ = net condenser heat-transfer resistance, thohms, $= 1/UA_c$.
$R_{UA,e}$ = net evaporator heat-transfer resistance, thohms, $= 1/UA_e$, Fahrenheit degree per (Btu) (hour).
r = electrical resistance corresponding to thermal resistance, ohms.
Δt = temperature difference, Fahrenheit degrees, between evaporator and condensing temperature.
$\Delta t_{t,c}$ = temperature difference, Fahrenheit degrees, between condensing vapor and coolant inlet temperature, also as indicated by special subscript.
$\Delta t_{t,e}$ = temperature difference, Fahrenheit degrees, between evaporating vapor and air-flow inlet temperature.
U = overall heat-transfer conductance, (coefficient), Btu per (square foot) (hour) (Fahrenheit degree), applicable, with subscript to either condenser or evaporator.
W_c = condenser-coolant flow rate, pounds per hour.
W_a = evaporator-air flow rate, pounds per hour.

†It must be pointed out that the validity of such a resistance calculation, and in fact, of any transient heat-flow calculation involving an enveloping fluid around a solid body depends entirely on the assumption of the heat-transfer properties entering into the calculation. The validity of these assumptions, particularly that of the surface conductance, is always a question, making the accuracy of a refined result somewhat questionable.

voltage‡ the counterpart of steady-state temperature difference.

In the present type of analysis, many simplifying assumptions are expedient. Idealized performance for the sake of clarification is assumed, although corrections to account for the performance of real equipment could be made. The essential purpose here is to develop further tools for use in electrical analogger operations.

Whatever energy is discharged from the compression machine as transport energy, it is important to note, must in turn flow through the condenser system. It must further be emphasized that this compression-machine energy is made up of the heat flow to the evaporator, plus the work-energy of compression. The extent of the temperature spread above the entering coolant temperature, as required by the resultant condenser-heat flow, will in turn determine the condensing-vapor temperature, and thus, in effect, the compressor delivery pressure.

Similarly, in terms of the structure air-circulation conditions of temperature and flow rate, the requisite temperature difference necessary for the evaporator heat transfer must establish the evaporator temperature. In this way the corresponding evaporator pressure — the suction pressure of the compressor plant — is established. The actual compressor energy, depending on real volumetric efficiency and hourly displacement, is subject to the terminal pressures of the system. It is subject, thus, to the condensing pressure (as determined by the condenser heat transfer), and to the evaporator pressure (as determined by the evaporator heat transfer).

The structure heat flow must be absorbed by the evaporator. In self-regulating the internal structure temperature under off-design conditions, the control of the amount of heat which must be picked up by the evaporator is effected. Thus, there will result some internal structure-temperature, wherein the load can be picked up by the evaporator, pumped to the higher temperature level of the condenser, such that it may appropriately be rejected to the condenser coolant.

It is then apparent that the structure-refrigerating plant complex, with all its components and their operating characteristics, presents a rather complicated thermal-circuit problem with respect to prediction of off-design performance.

‡Use might be made of a variable-voltage electrical generator to represent the compressor-machine characteristics with respect to varying effective temperature difference. It seems simpler, however, to use an impressed overall voltage; as on the paralleling condenser system.

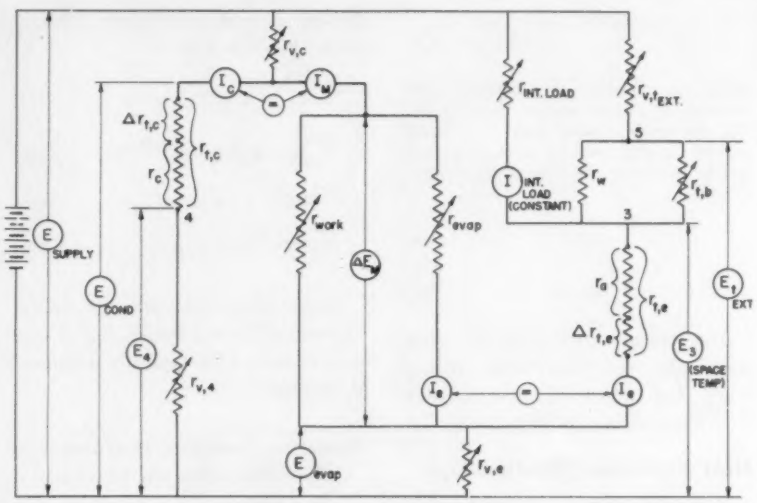

Fig. 5—Electrical Analogger Circuit for the process-complex of refrigerating plant and cooled structure

Analogger Circuit

Fig. 5 shows the complete electrical analogger circuit for the process-complex, combining the structure thermal circuit as an integral part of the refrigerating-plant thermal circuit.

The analogger circuit is set up as a network involving several parallel branches. It comprises two separate and adjustable resistances, in parallel, to represent the work- and the evaporator-heat phases of the compression machine system. The total current contributed by these two branches must equal that flowing through the condenser circuit, with the top potential common to both condenser and machine sections. The potential value corresponding to the coolant-inlet temperature at point 4 is maintained on the condenser circuit by means of an adjustable ballast resistance $r_{v,4}$. The evaporator heat-transfer section, the counterpart of the condenser heat-transfer section, is separately established as an integral part of the structure-cooling circuit. In operation, its energy flow must be matched by that through the evaporator branch of the machine circuit, as attested by the corresponding current meters, I_e.

Both the condenser and the evaporator heat-transfer total resistances, r_{tso} and r_{tse}, include their respective fluid-exchange resistances r_c and r_e. Particularly to be noted is that the external-air-temperature potential at point 5 is maintained at some specified value as required by t_{ex}. The value of the transient-body resistance r_{tb} is set as corresponding to the particular point of time for which the study is made. Control to bring the evaporator current meters I_e into agreement is made by means of an adjustable *evaporator* ballast resistance $r_{v,e}$. This governs the bottom evaporator potential, with aid through trimming corrections on the machine variable resistances. The resultant potential difference between the evaporator and the condensing-vapor potential, representative of the machine pressure span, is in turn utilized to

determine the effective resistances of the compressor elements r_{evap} and r_{work}. The base or ground potential of the system is taken as 0 F.

Adjustment of the analogger circuit is made progressively through change in the condensing-vapor potential by the variable resistance r_{vc}. This must establish the condenser current I_c equal to the compressor current I_m, while simultaneously keeping the potential at point 4 (coolant-inlet temperature) at its proper value, along with the potential at point 5 (external air temperature) at its specified value. Coincidental values of r_{evap} and r_{work} are maintained at their particular values as dictated by the machine potential difference $\triangle E_m$. As noted previously, the evaporator current meters are kept alike in value.

The current meters show the equivalent energy flowing at given points; the potentials show the equivalent temperatures. Adjustment of this type of integrated heat-power analogue, it must be recognized, is a matter of manual dexterity, somewhat simplified by the use of automatic equipment, a voltage regulator for example.

Illustrative Example

An insulated structure, 40 × 20 × 10 ft, designed for industrial air-conditioned process purposes, is to be maintained at 55 F under conditions of 95 F outside, with water supply for the condenser at 70 F. The walls, of light-weight construction with reflective insulation, have negligible heat capacity. Including an allowance for incoming ventilation air, the total structure heat flow may be taken as 700 Btu per (hr) (F deg). An internal heat load due to power and lights is specified as 15,500 Btu per hr. The influence of the introduction of a hot load initially at a uniform temperature of 95 F, on the structure-space temperature is to be investigated as a function of time.

The hot load may be considered as a tightly packed stack 20 × 6 ft, and 2 ft thick, having the following uniform properties: density ρ, 94 lb per cu ft; specific heat c_b, 0.22 Btu per (lb) (F deg); and thermal conductivity k, 0.70 Btu per (sq ft) (hr) (F deg per ft); together representing a thermal diffusivity a of 0.034. The surface conductance h_a is assumed to have the general value of 2 Btu per (sq ft) (hr) (F deg).

Journal Section

For the refrigeration plant: compressor displacement, 11.2 cfm; condenser heat-transfer surface, 16.85 sq ft; condenser coolant-inlet temperature is 70 F, and its coolant flow rate W_c at 1800 lb per hr. The structure-space air circulation rate over the air-cooling coils (evaporator) is to be taken at 7000 lb per hr, corresponding to about 1600 cfm, and specific heat, $c_a = 0.24$.

In accordance with the provisions of Equation 5, and the specified heat-transfer properties for the *hot* load material, Fig. 6 has been developed. This shows the variation of heat dissipated off the surface for two air temperatures, namely 55 and 65 F, as a function of time. Since at the beginning of exposure to the lower room-temperature-air the heat loss is rather high, tending quickly to raise the structure-air temperature, and also in view of the general indefiniteness of the value for h_a in practice, it is regarded as desirable to use a modified curve for the heat loss, as indicated in Fig. 6. The correspond-

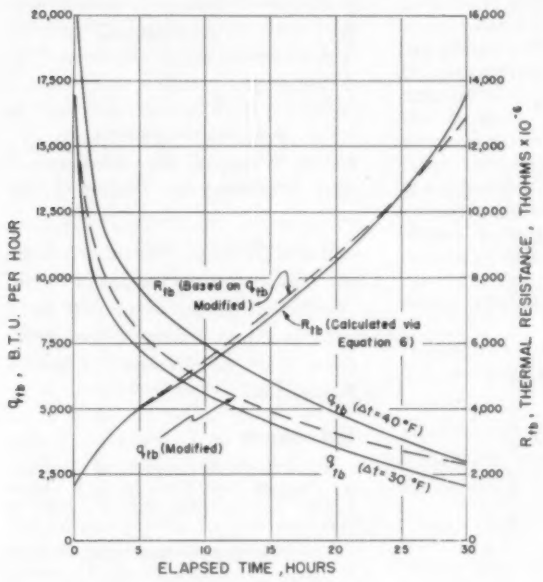
q_{fb}, B.T.U. PER HOUR
R_{fb}, THERMAL RESISTANCE, THOHMS x 10^{-6}
ELAPSED TIME, HOURS
R_{fb} (Based on q_{fb} Modified)
R_{fb} (Calculated via Equation 6)
q_{fb} (Δt = 40 °F)
q_{fb} (Modified)
q_{fb} (Δt = 30 °F)

Fig. 6—Transient body heat flow and equivalent resistance as a function of time

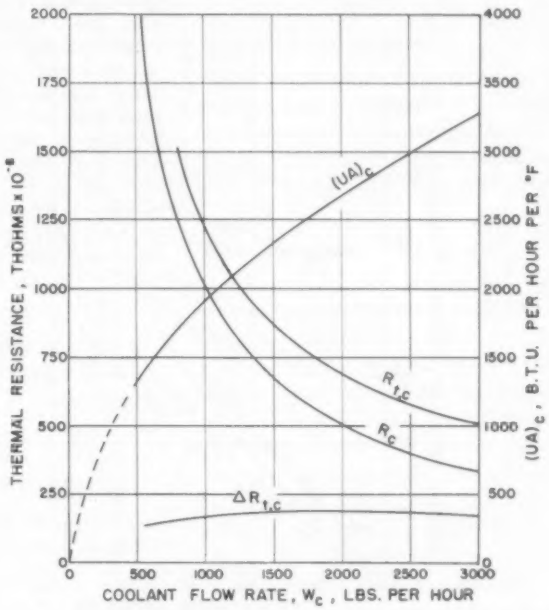

Fig 7—Condenser performance curves as a function of coolant flow rate

ing value for the transient-body gross resistance R_{tb} is likewise shown. The temperature difference for the transient-body resistance R_{tb} may be assumed as for the wall*, *i.e.* $\triangle t_w$.

Resistance values for the condenser, to correspond with those of Equations 7, 8, 9, and 10, are directly obtained from Fig. 7, typified originally by Fig. 4. In Fig. 7, values for the product UA_c are included, all values being plotted against W_c, the hourly rate of condenser water flow.

Corresponding to the air flow rate of 7000 lb per hr, and in terms of Equation 13, $R_a = 595 \times 10^{-6}$ thohms; via Equation 12, $R_{t\text{-}e} = 752 \times 10^{-6}$ thohms; and via Equation 14, $\triangle t_{t\text{-}e} = 157 \times 10^{-6}$ thohms. These air values are the counterpart of those for the condenser in Fig. 7.

Hourly heat values, as typified by Fig. 1, taking real volumetric efficiency into consideration, are utilized to develop Fig. 8 for machine resistance values, as plotted against equivalent temperature differences between evaporating and condensing conditions. Equivalent resistance values, R_{evap} and R_{work}, for the compressor-machine performance in accordance with Equation 1, are specifically shown in Fig. 8, as thohms.

The equivalent thermal resistance for the wall plus ventilation air, and neglecting wall heat-storage effects, is to be taken at $R_w = 1430 \times 10^{-6}$ thohms, and constant. The constant internal heat load is specified at 15,500 Btu per hr.

Electrical circuit values, as translated from Figs. 6, 7, and 8, the wall and internal heat values, and the specified-evaporator-air-cooling data according to Equations 12, 13, and 14 specified for use in the analogger arrangement of Fig. 5, are on the basis of 1 ohm electrical resistance $= 10^{-6}$ thermal resistance thohms, 1 volt = 10 F, and 1 milliampere = 1000 Btu per hr.

Fig. 9 shows the variation of the structure-space temperature as a function of time, in hours, after the introduction of the *hot* bulk load into the cooled space, determined stepwise for different time intervals.

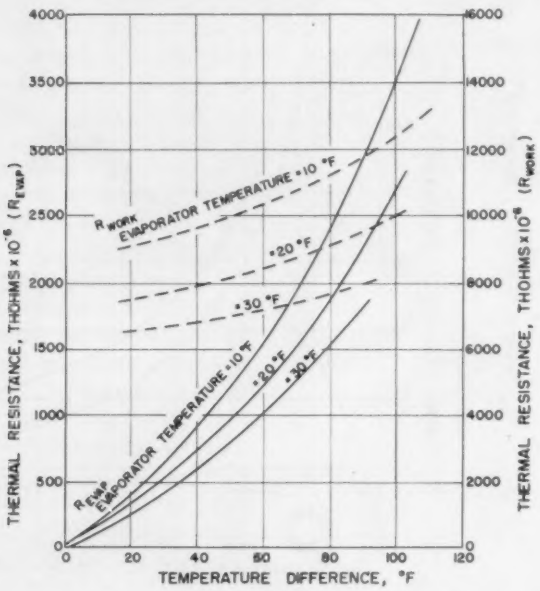

Fig. 8—Compressor performance curves as a function of generated temperature difference

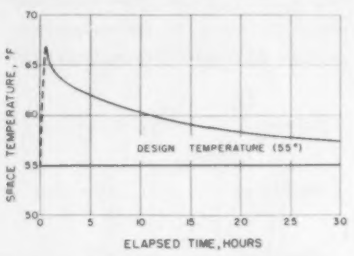

Fig. 9—Variation of cooled-structure space temperature as a function of time

Acknowledgment

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*Whereas conventionally in transient heat flow analysis, account must be taken of heat storage effects — represented by electrical capacitance in usual electrical analogy studies — here the transient process may be adequately handled through the resistance concept, using effective resistance values changing with time.

Characteristics of Downward Jets from a Vertical Discharge Unit Heater

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This paper is the result of research sponsored by the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS, INC. in cooperation with the Engineering Experiment Station of Kansas State College.

SUMMARY — This paper deals with the characteristics of jets discharged from a vertical discharge unit heater, equipped with either an annular outlet or a shallow diffuser. The following experimentally determined data are presented: (1) velocities and temperatures along the vertical axis of the jet discharged from the heater; (2) velocities and temperatures in the region of fully developed flow; and (3) temperatures in the space surrounding the jet. An example shows how to put the data to practical use. The paper supplements a previous paper[2] on the same subject.

UNDER the guidance of the TAC on Air Distribution, an exploratory study of jets of heated air from a vertical discharge unit heater was undertaken as an intermediate step in the jointly sponsored research on downward jets of heated air being conducted at Kansas State College. The objectives of this exploratory study were to: (1) Obtain data descriptive of the behavior of vertical jets of heated air of the type encountered in practice; (2) Compare and correlate data on the down-throw of such jets with data on the down-throw of jets from long radius *ASME* nozzles published in a previous paper[1]; (3) Obtain guidance for future research.

The second of these objectives was dealt with in a paper[2] presented before the Society at its Semi-Annual meeting in June 1954. That paper gave data on the down-throw of heated jets from a vertical discharge unit heater for three types of outlets and by means of a throw factor, f, correlated these data with corresponding data on jets discharged from long-radius *ASME* nozzles. In addition, the paper gave data on the pattern of flow over a distance approximately 3.5 outlet diameters down from the outlet.

The present paper deals with: (1) a study of the remaining portion of the jet discharged from the unit heater, that is, with the section that extends downward from a level approximately 2 outlet diameters below the outlet; and (2) with the distribution of temperatures in the space surrounding the jet. Two of the 3 outlets previously employed were used: the annular outlet and the shallow diffuser. Two non-isothermal jets and 1 isothermal jet discharged from the annular outlet and 1 non-isothermal jet discharged from the shallow diffuser were investigated. The data obtained are presented graphically:

1. As plots of velocities and temperatures along the vertical axis of the jet discharged from the unit heater;
2. As plots of velocities and temperatures along the diameter of the jet at representative levels;
3. As maps of constant temperature contour lines indicative of the distribution of temperatures in the space surrounding the jet.

Simple formulas are given for the velocities and the temperatures along the vertical axis of the jet.

Distribution of velocities and temperatures in the heated jet did not support the use of simplifying assumptions which imply similarity in the pattern of flow at different levels of a vertical jet of heated air. However, velocities and temperatures along the axis of the jet were not inconsistent with analytically developed equations based on such simplifying assumptions. In the space surrounding the jet, the constant-temperature contour lines close to the jet followed the form of the jet. Remote from the jet these lines were asymptotic to horizontal lines.

The estimated apparent boundary forces, evaluated as unaccounted-for forces acting on the jet, were found to be substantial. The hourly rate of room air entrainment per foot of travel was found to be a constant for the isothermal jet over the range of travel investigated. For the non-isothermal jets, it decreased with travel and became zero at, roughly, the midpoint of travel, after which the mass rate of flow progressively decreased.

Equipment and Procedure

Fig. 1 shows the test set-up. The unit heater was housed in an elevated plenum chamber in which atmospheric pressure was maintained by means of an external blower. Fig. 2 shows the unit heater and the two outlets employed. The annular outlet had vertical guide vanes; the shallow diffuser had adjustable guide vanes set in their vertical position. No attempt was made to determine the most favorable setting of the vanes for the shallow diffuser, and the vertical setting employed may not have been a favorable setting from the point of view of operating performance, although satisfactory for the purposes of the tests.

The techniques and procedures previously used and described were again employed. The bottom of the jet was located in each case by simultaneously moving a thermocouple and a Prandtl tube upward into the stream and noting the first point at which both gave evidence of being in the jet. This point was approximately 1 outlet diameter above the point which would have been established as the bottom of the jet by temperature readings alone. Temperatures and velocities measured within the boundaries of the jet were recorded by means of single point, high-speed, electronic, curve-drawing instruments. Temperatures in the space

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[1]Exponent numerals refer to References.
For presentation at the 62nd Annual Meeting of the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS, Cincinnati, Ohio, January 1956.

surrounding the jet were recorded by means of a 20-point, high-speed, electronic, curve-printing recorder. This unit was connected to a four-bank external switch.

To establish outlet conditions, comprehensive velocity and temperature traverses were made at the face of the outlet. Maximum local velocities and temperatures in the region of fully developed flow were located and plotted by carefully exploring the central region of the jet at levels approximately 1 ft apart.

Fig. 3 shows the arrangement and locations of the thermocouples installed on the instrument carriage for measuring temperatures in the space surrounding the jet. A total of 121 readings were taken at each level explored, beginning with a level located 2 outlet diameters below the outlet face and ending with a level approximately 4 outlet diameters above the floor.

The mass rate of flow and the momentum flux were evaluated from velocity and temperature profiles established by the procedure illustrated in Fig. 4.

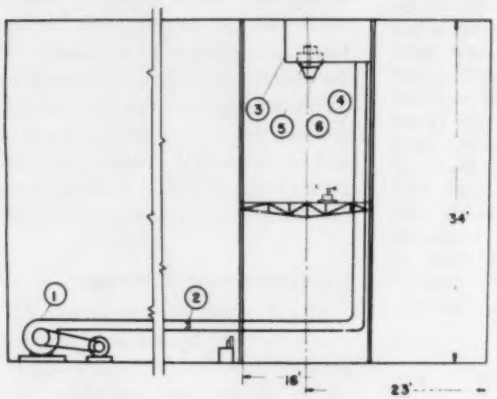
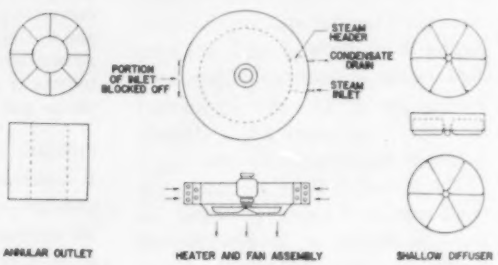


Fig. 1—Schematic arrangement of equipment. Reference numbers: (1) blower; (2) measuring nozzle; (3) plenum chamber; (4) heater; (5) fan; and (6) outlet

Fig. 2—(*below*) Schematic drawing of heater and outlets. For symmetry; a segment of the air inlet equivalent to the steam header was blocked off



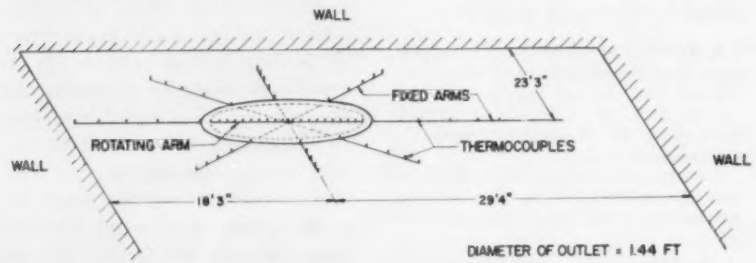


Fig. 3—An assembly of fixed, radial arms, each with five thermocouples, and one rotating central arm with 21 thermocouples were used to obtain the horizontal distribution of temperature in the space surrounding the jet. The assembly was moved vertically to representative levels. At each level 121 temperature readings were obtained

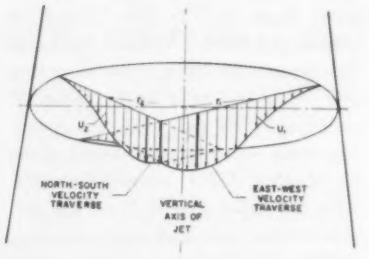


Fig. 4—Velocities were measured along North-South and East-West chords which intersected on the vertical axis of the outlet. These velocities were replotted against their distance, r, from the jet axis. Thus U_1 was plotted against r_1, U_2 against r_2, etc., to form profiles based upon the jet diameter

Table 1. Test Conditions

	Annular Outlet			Shallow Diffuser
	Non-Isothermal		Isothermal	Non-Isothermal
	Case I	Case II		
	1	2	3	4
Gage Pressure in Plenum Chamber	0	0	0	0
Steam Pressure, psig	25	50	..	50
Outlet diameter, D_o, ft	1.44	1.44	1.44	1.44
Flow at outlet, cfm	1620	1610	1640	1440[a]
Avg Outlet Vel., $\overline{U_o}$, fps	16.6	16.5	16.8	14.7
Avg Outlet Vel., fpm	994	987	1000	882
Heat Delivery, Btu/hr	56,900	86,800	..	80,100
Avg Outlet Temp., $\overline{T_o}$, R deg	584	597	..	596
Avg Outlet Temp., F deg	124	137	..	136
Room Temp., T_a, R deg	543	537	544	535
Room Temp., F deg	83	77	84	75
Avg Temp. of Air entering Plenum Chamber	86	79	..	76
Relative Outlet Downthrust	1.35	1.45	..	1.28
$\overline{B_o} = [\overline{U_o}^2/(gD_o)]/(\overline{T_o}/T_a - 1)$	78	52	..	41
Throw, L_{max}, feet	22.5	18.5	..	12.5
Throw Factor, $f = (L_{max}/D_o)/(1.7\sqrt{B_o})$	1.04	1.05	..	0.80

[a]Adjustable guide vanes arbitrarily set vertical, not in position for maximum output.

Test Conditions

The test conditions under which the jets discharged from the unit heater were investigated are tabulated in Table 1. With the annular outlet, 3 different jets were investigated; 2 non-isothermal jets with different outlet temperatures and 1 isothermal jet. Only a non-isothermal jet was investigated using the shallow diffuser. In all tests, atmospheric pressure was maintained in the plenum chamber.

The test conditions employed permit one to compare the performances of: (1) an isothermal and a non-isothermal jet discharged from the

same outlet; (2) two non-isothermal jets with different heat quantities discharged from the same outlet; and (3) two non-isothermal jets delivering approximately the same heat quantity discharged from 2 different outlets.

The temperature distribution in the space surrounding the jets was established by a separate investigation using both outlets. The test conditions were the same as those listed in Table 1, Columns 2 and 4, but the throws obtained were 8 percent greater than the throws tabulated in these columns.

In comparing the test data in Table 1 with corresponding data of the previous paper, it should be noted, that the figures in Table 1 resulted from tests with a fan, the blades of which had appropriate tip clearances. Two fans were used for the tests reported in the previous paper, but one of these had blades the tip clearances of which were excessive.

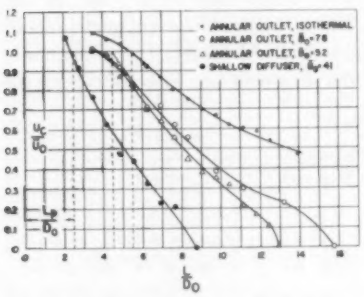


Fig. 5—Maximum local velocity, U_c, defined as velocity on vertical axis of jet. Distance, L/D_o, down from face of outlet in outlet diameters. $\overline{U}_o$ = average velocity at outlet. Values plotted are values obtained below the level at which fully developed flow was first established

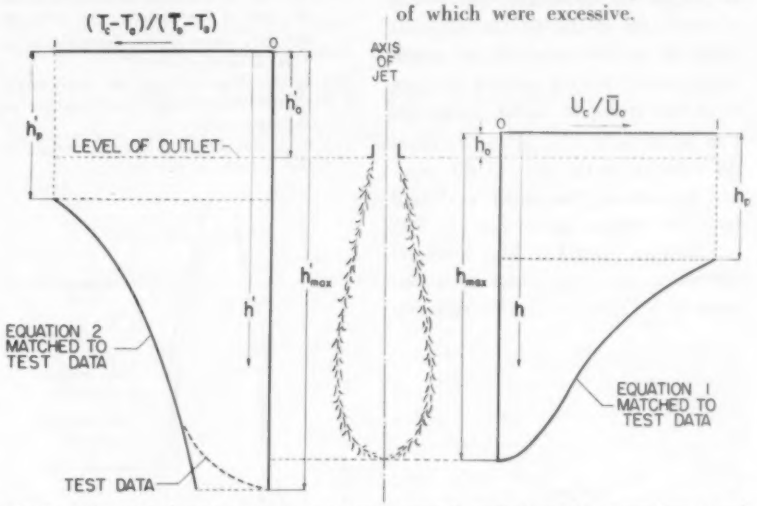


Fig. 7—Schematic drawing illustrating significance of symbols used in Equations 1 and 2. b'_o, which locates the origin, O, for plotting $(T_c - T_a) / (\overline{T}_o - T_a)$ *vs.* b', and b_o, which locates the origin for plotting $U_c/\overline{U}_o$ *vs.* b, were determined by a trial and error matching of experimental data and the equations. The subscript p indicates the point at which the ordinate $(T_c - T_a) / (\overline{T}_o - T_a)$ or $U_c/\overline{U}_o$ has a value of unity

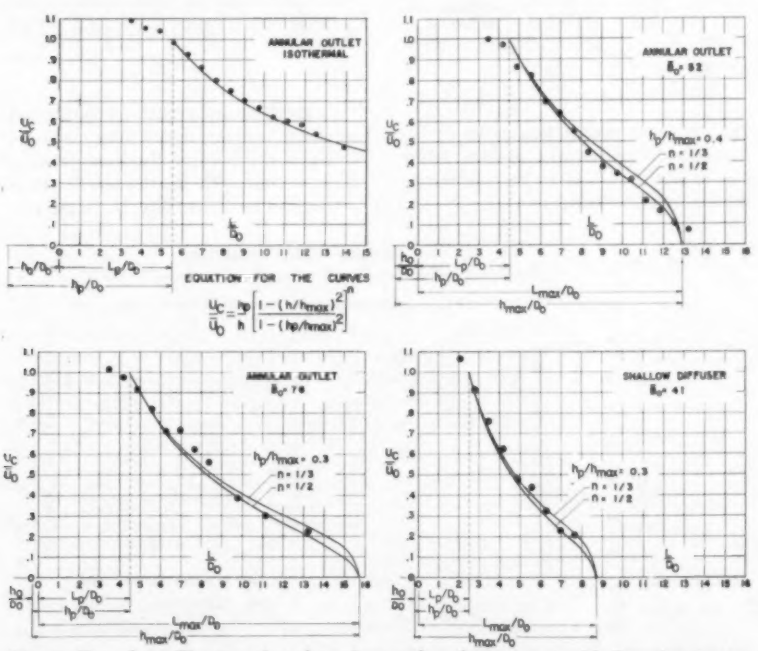


Fig. 6—Data from Fig. 5 replotted to show order of agreement with Equation 1, represented by solid lines. b_o and n were determined by a cut and trial matching of the equation with test data. U_c = velocity at axis of jet, $\overline{U}_o$ = velocity at outlet, L = distance down from outlet, and D_o = outlet diameter

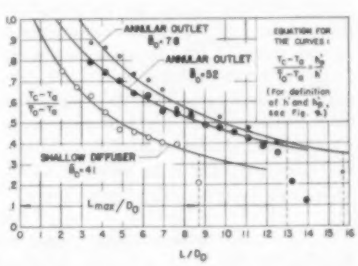

ANNULAR OUTLET B_o=.78
ANNULAR OUTLET B_o=.52
SHALLOW DIFFUSER B_o=.41
EQUATION FOR THE CURVES
(For definition of h and h_p, see Fig. 6)

Fig. 8—Ratio of temperature elevation, $(T_c - T_a)$, along axis of jet following the establishment of fully developed flow to temperature elevation at outlet, $(\overline{T}_o - T_a)$, distance from outlet in outlet diameters. The solid lines represent Equation 2. Agreement with the equation is satisfactory except for the points that follow the break in curve of plotted data near the bottom of the jet

Detailed Experimental Data and Results

Although broad generalizations cannot be drawn from the experimental data obtained, various significant characteristics have been revealed. These are presented in the

following as being of both practical and theoretical interest:

1. Velocities and Temperatures along Vertical Axis of Jets: Fig. 5 is a graph of velocities along the vertical axis of the jets investigated (defined as the locus of maximum local values) plotted against distance from the outlet in outlet diameters. The ordinate $U_c/\overline{U}_o$ is the ratio of the velocity at the axis to the average velocity at the outlet evaluated from the volume rate of flow. In Fig. 6, velocities plotted in Fig. 5 are replotted to show the order of agreement with Equation 1. This equation is a correlating equation the form of which was obtained analytically on the basis of simplifying assumptions. It represents the ratio of the centerline velocity, U_c, to the average velocity, $\overline{U}_o$, as a function of 3 factors (refer to Fig. 7):

(*a*) h_p, the distance from an origin on the vertical axis of the jet h_o ft above the face of the outlet to the point on the axis where $U_c/\overline{U}_o$ from Equation 1 has a value of unity;

(*b*) h, the distance from the same origin to the point under consideration on the axis; and

(*c*) h_{max}, the distance from the origin to the bottom of the jet.

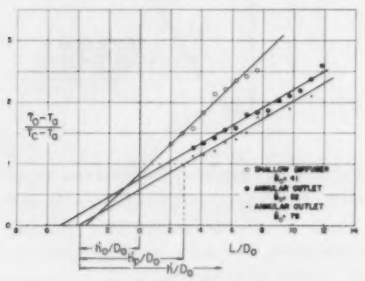


Fig. 9—In this figure, the reciprocal of the ordinates of Fig. 8 has been plotted against travel, L/D_o. In agreement with Equation 2, the points plotted are represented by straight lines. L/D_o is measured from the zero point; b'/D_o from a point b'_o/D_o outlet diameters to the left of the zero point; b'_p/D_o is the value of b'/D_o where $(T_c - T_a) / (\overline{T}_o - T_a) = 1$

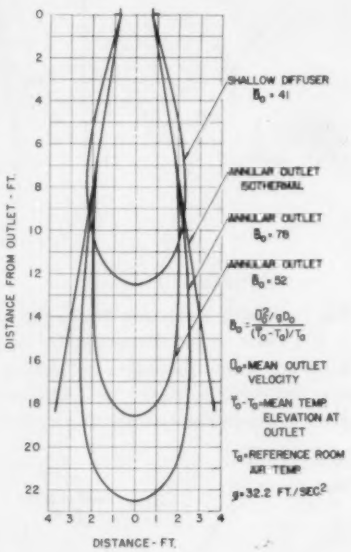


Fig. 10—Approximate boundaries of jets determined from velocity profiles. Diameter of outlet = 1.44 ft. For outlet conditions, refer to Table 1

The exponent, n, in Equation 1, as well as h_o is treated as an empirical factor. Values of these factors were obtained by a cut and trial matching of data with curves representing the equation:

$$U_c/\overline{U}_o = (h_p/h) \{[1 - (h/h_{max})^2] / [1 - (h_p/h_{max})^2]\}^n \quad ..(1)$$

Equation 1 with n = 1/3 is equivalent to Koestel's equation[3] for centerline velocities. With n between 1/3 and 1/2, the equation matches the experimental data well. However, undue significance should not be attached to this apparent matching of test data with theory. In the first place, the exponent, n, is sensitive to the

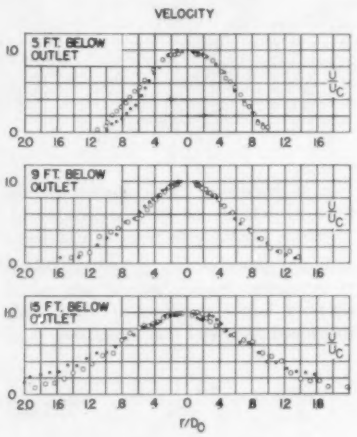


Fig. 13—Velocity profiles of isothermal jet from annular outlet. The ordinate, U/U_c, is the ratio of the local velocity, U, at distance r/D_o outlet diameters from the jet axis to the velocity, U_c, at the axis

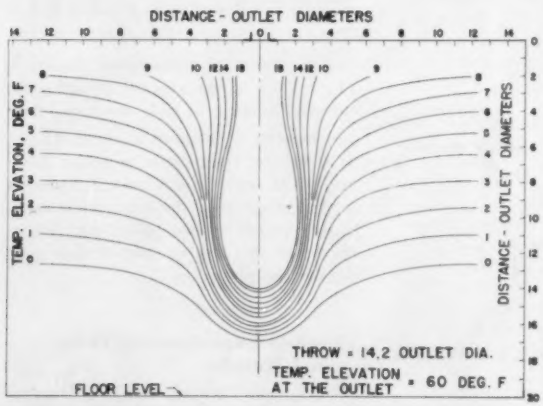

DISTANCE - OUTLET DIAMETERS
TEMP. ELEVATION, DEG. F
DISTANCE - OUTLET DIAMETERS
THROW = 14.2 OUTLET DIA.
TEMP. ELEVATION AT THE OUTLET = 60 DEG. F
FLOOR LEVEL

Fig. 11—Distribution of temperature in space surrounding the jet from annular outlet. Contour lines are lines of constant-temperature elevation above reference room temperature measured 30 in. above the floor at a point remote from the jet

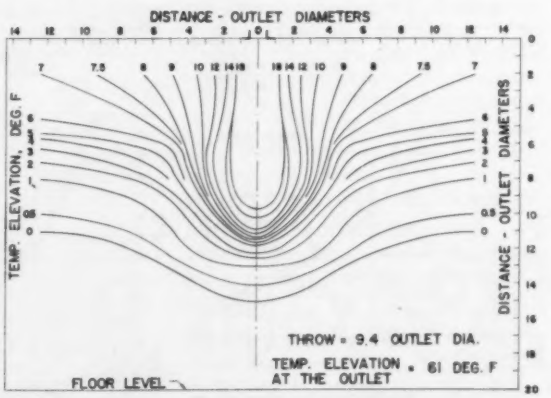

DISTANCE - OUTLET DIAMETERS
TEMP. ELEVATION, DEG. F
DISTANCE - OUTLET DIAMETERS
THROW = 9.4 OUTLET DIA.
TEMP. ELEVATION AT THE OUTLET = 61 DEG. F
FLOOR LEVEL

Fig. 12—Distribution of temperature in space surrounding the jet from shallow diffuser. Contour lines are lines of constant-temperature elevation above reference room temperature measured 30 in. above the floor at a point remote from the jet

terminal shape of the curve of axial velocities *vs.* travel, and this shape must, in some measure, be estimated. In the second place, the derivation of the equation was based on convenient, simplifying assumptions.

Fig. 8 shows temperatures along the vertical axis of the jets plotted against distance down from the outlet in outlet diameters. The solid curves represent the equation:

$$(T_c - T_a)/(\overline{T}_o - T_a) = h'_p/(L + h'_o) = h'_p/h' \quad \ldots(2)$$

The left-hand side of this equation is the ratio of the temperature elevation along the vertical axis of the jet to the temperature elevation at the outlet. The right-hand side is simply the product of h'_p (see Fig. 7) and the reciprocal of the quantity obtained by adding h'_o to the travel, L. The manner in which h'_p and h'_o were evaluated is illustrated in Fig. 9.

Table 2 gives values of h_o/D_o, h'_o/D_o, h_p/D_o and h'_p/D_o.

2. Jet Boundaries: The approximate boundaries of the jets studied are shown in Fig. 10. These were established by means of Prandtl tube determinations of the surface of zero downward velocity. This method provides comparable, qualitative data on the jet envelopes, but not definitive data.

3. Temperature Distribution in the Space Surrounding the Jets: Figs. 11 and 12 show the distribution of temperatures in the space surrounding each of 2 jets, one discharged from the annular outlet, the other from the shallow diffuser. The lines drawn on these figures are lines of constant elevation of temperature, $(T - T_a)$. Each point used to establish these lines is the average of 8 temperature readings distributed in a circle about the vertical axis of the jet employed.

In the immediate vicinity of the jet, the lines of constant temperature elevation followed the contour of the jet. Remote from the jet, they became asymptotic to a horizontal

Table 2. Values of b_o/D_o, b'_o/D_o, b_p/D_o and b'_p/D_o
(See Fig. 7, also Figs. 6 and 9)

	b_o/D_o	b'_o/D_o	b_p/D_o	b'_p/D_o
Annular Outlet				
(1) Isothermal Jet	2.5	..	8.0	..
(2) $\overline{B}_o = 78$	0.28	4.00	4.80	6.90
(3) $\overline{B}_o = 52$	1.11	5.20	5.63	6.95
Shallow Diffuser				
$\overline{B}_o = 41$	0.15	3.50	2.65	4.20

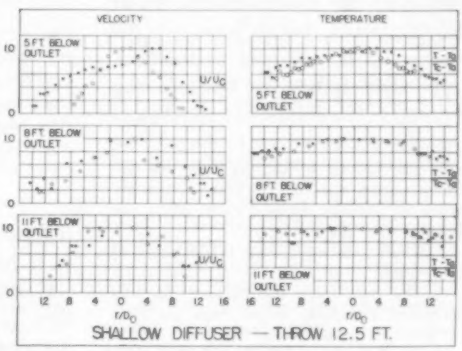


Fig. 14—Velocity profiles, left, and temperature profiles, right, of jets from annular outlet and shallow diffuser. U/U_c = ratio of local velocity, U, at distance r/D_o outlet diameters from axis to velocity, U_c, at axis. $(T - T_a) / (T_c - T_a)$ = ratio of local temperature elevation, $T - T_a$, to temperature elevation, $T_c - T_a$, at axis

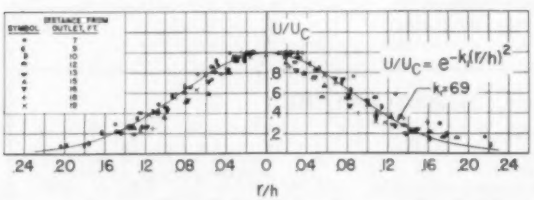
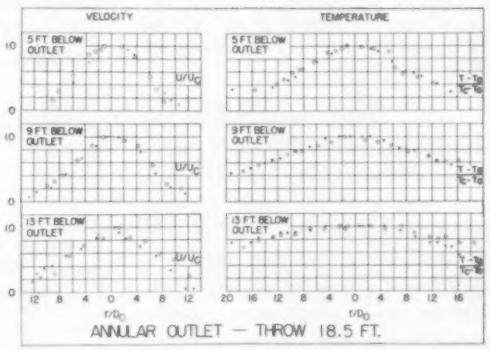


Fig. 15—Composite plot of all velocity profiles for jet from annular outlet wth $\overline{B}_o = 78$ and throw = 22.5 ft. (See Fig. 14 for profiles at representative levels). The spread of points indicates that similarity in the pattern of flow was not maintained along the path of travel. r = radial distance from axis of jet; h = distance down from origin h_o/D_o outlet diameters above face of outlet. $h_o/D_o = 0.28$



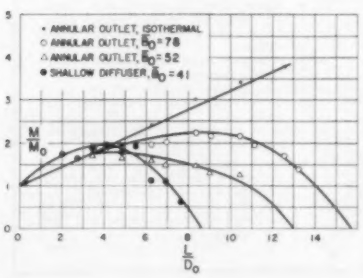
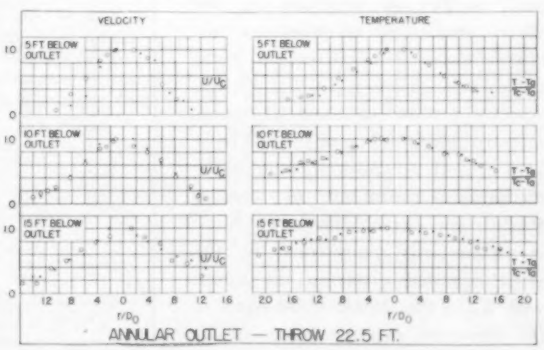


Fig. 16—Ratio of mass rate of flow, M, at level L/D_o outlet diameters down from outlet to mass rate of flow, M_o, at outlet



line. At the immediate boundary of the jet, the temperature elevation decreased rapidly in a radially outward direction. In the space remote from the jet, a substantial, vertical temperature gradient existed. Immediately below the jet, there existed a region of elevated temperature. In this region, an intermittent upward flow of air occurred, induced by the elevated temperature.

The temperature distribution represented by Figs. 11 and 12 should not be regarded as representative of practice, since the unit heater was employed, not as it ordinarily would be in practice, but to produce a jet that could be regarded as being an approximately free jet. The following factors, in this regard, are significant:

1. The bottom of the jet from the annular outlet was 8.5 ft, that of the jet from the shallow diffuser 15 ft, above the level of the floor.
2. There was no ceiling at the level of the outlet.
3. The base room temperature, T_a, was measured at a level 30 in. above the floor at a point remote from the jet.
4. In the absence of artificial heating, a temperature difference of 3 deg existed between the temperature of the room at the level of the outlet and the temperature 30 in. above the floor.

4. Cross Jet Velocity and Temperature Profiles: Figs. 13 and 14 show representative velocity and temperature profiles of the type employed for evaluating the mass rate of flow, the momentum flux, and the buoyancy forces acting on the jets. These velocity and temperature profiles were obtained by superposing, in one case, profiles of velocities, in the other, profiles of temperatures, obtained along 2 diameters at right angles to each other. In Fig. 15, the velocity profiles obtained at representative levels of one of the jets have been replotted against a common dimensionless coordinate to form a single mean curve. This mean curve is satisfactorily represented by the error equation given in the figure with K_1 in that equation set equal to 69. However, extreme values of K_1 for the band of data plotted have a ratio of approximately 2 to 1.

5. Flow Rate and Air Entrainment: Fig. 16 shows the mass rate of flow plotted against travel in outlet diameters. The curve for the isothermal jet is a straight line. This signifies that the amount of room air entrained each hour over each foot of travel was essentially a constant for the extent of the jet investigated. The curves for the non-isothermal jets are concave viewed from the x axis. This indicates that the non-isothermal jets entrained air at a decreasing rate over the first part of their travel and then ejected air to the surrounding space.

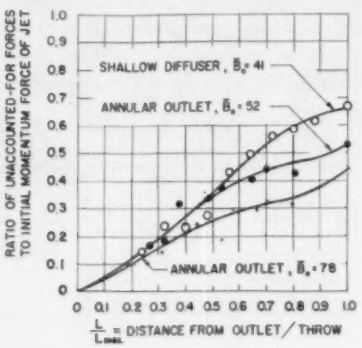

RATIO OF UNACCOUNTED-FOR FORCES TO INITIAL MOMENTUM FORCE OF JET
SHALLOW DIFFUSER, $\overline{B}_o$ = 41
ANNULAR OUTLET, $\overline{B}_o$ = 52
ANNULAR OUTLET, $\overline{B}_o$ = 78
$\frac{L}{L_{max}}$ = DISTANCE FROM OUTLET / THROW

Fig. 17—Unaccounted-for forces (apparent boundary forces) acting on the jet between the outlet and levels L feet down from the outlet, evaluated as the difference between the decrement of momentum flux and the impressed buoyancy force

6. Buoyancy Force and Jet Momentum: The difference between the change in the momentum flux and the buoyancy force is the sum of the apparent boundary forces, or unaccounted-for forces. Fig. 17 is a graph of such forces expressed as a fraction of the momentum flux at the outlet. It is quite possible that the boundaries of the jets were not ascertained with an accuracy sufficient to evaluate the buoyancy forces, and that this accounts to some extent for the magnitude of the unaccounted-for forces. However, unaccounted-for forces of the same order of magnitude were obtained by Nottage[4] in his experiments on a chilled jet.

Example Illustrating Use of Data Presented

Problem: Determine the temperature and velocity at the face of the outlet for a jet of heated air projected downward

GLOSSARY OF TERMS

Relative downthrust = ratio of actual downthrust at face of issuing jet to downthrust that a flat velocity profile would have developed with the same flow and the same outlet diameter, D_o.
Bottom of jet = point at which a thermocouple and a Prandtl tube simultaneously moved upward along the axis of jet from floor level give first distinct evidence of entering the jet.
Boundary of jet = surface of zero downward velocity as approximated by a Prandtl tube.

NOMENCLATURE

$\overline{B}_o$ = cross-stream average buoyancy number at outlet = $(\overline{U}_o^2/gD_o)/[(\overline{T}_o - T_a)/T_a]$.
c = subscript indicates value on axis of jet, defined as locus of maximum local values of temperature or velocity.
D_o = outlet diameter, feet.
g = gravitational acceleration, 32.2 feet per (second) (second).
f = throw factor.
b = vertical coordinate for locating velocities, feet.
b_o = distance from origin of b to face of outlet, feet.
b_p = distance from origin of b to point at which U_c on curve of U_c versus L/D_o extended equals $\overline{U}_o$, feet.
b_{max} = distance from origin of b to bottom of jet (see glossary of terms), feet.
b' = vertical coordinate for locating temperature, feet.
b'_o = distance from origin of b' to face of outlet, feet.
b'_p = distance from origin of b' to point at which $(T_c - T_a)$ on curve of $(T_c - T_a)$ versus L/D_o extended equals $(\overline{T}_o - T_a)$, feet.
b'_{max} = distance from origin of b' to point on axis of jet where $(T_c - T_a)$ is zero ft.
L = distance down from outlet, feet.
L_p = $b_p - b_o$, feet.
L_{max} = distance from outlet to bottom of jet = $b_{max} - b_o$, feet.
M = mass rate of flow at any designated level, pounds per second.
M_o = mass rate of flow at outlet, pounds per second.
o = subscript referring to outlet.
r = radial distance from axis of jet to point of jet under consideration, feet.
T = local temperature at any designated point of jet, Fahrenheit absolute.
$\overline{T}_o$ = mass-mean temperature at outlet, Fahrenheit absolute.
T_c = temperature along axis of jet defined as locus of maximum local values, Fahrenheit absolute.
T_a = temperature of undisturbed room air measured at instrument table 30 in. above floor, Fahrenheit absolute.
t_a = reference room temperature, Fahrenheit degrees.
t_c = temperature at axis of jet L ft down from outlet, Fahrenheit degrees.
U = local velocity at any designated point of jet, feet per second.
$\overline{U}_o$ = cross-stream average velocity at outlet = (volume rate of flow)/$[\pi D_o^2/4]$, feet per second.
U_c = velocity along axis of jet defined as locus of maximum values, feet per second.

from a unit heater so as to reach the floor level with a maximum local velocity of 120 fpm and a maximum local temperature elevation of 15 deg above a reference room temperature of 70 F. The diameter of the outlet is 1 ft and the distance from the face of the outlet to the floor is 20 ft. The throw factor, f, of the outlet is assumed to be 0.90.

In terms of the symbols in the Nomenclature the following are the data given:

D_o = diameter of outlet = 1 ft.
f = throw factor = 0.90.
t_a = reference room temperature = 70 F.
T_a = absolute reference room temperature = 530 R (Rankine degrees).
L = distance from the outlet to the level of the point under consideration = 20 ft.
U_c = velocity at axis of jet L ft down from outlet = 120/60 = 2 fps.
t_c = temperature at axis of jet L ft down from outlet = 15 + 70 = 85 F.
T_c = absolute temperature at axis of jet L ft down from outlet = 545 R.

The problem is to find:

(1) $\overline{T}_o$ = mass mean temperature at outlet, Rankine degrees.

(2) $\overline{U}_o$ = average velocity at outlet, feet per second.

Solution: From Equation 2:

$$(T_c - T_a)/(\overline{T}_o - T_a) = h'_p/(L + h'_o) = (D_o/D_o)[h'_p/(L + h'_o)] = (h'_p/D_o)/[(L/D_o) + (h'_o/D_o)] \quad \ldots\ldots(3)$$

where

h'_p and h'_o = empirical factors (see Table 2 for values of h'_p/D_o and h'_o/D_o).

Let $h'_p/D_o = 5$; $h'_o/D_o = 4$

$\overline{T}_o - T_a = (T_c - T_a)[(L/D_o + h'_o/D_o)/h'_p/D_o] = 15\,[(20 + 4)/5] = 72$

$\overline{T}_o = T_a + 72 = 530 + 72 = 602$ R

$\overline{t_o}$ = 142 F

Now apply Equation 1:

$$U_c/\overline{U}_o = (h_p/h)\,\{[1 - (h/h_{max})^2]/[1 - (h_p/h_{max})^2]\}^n$$

where

$h = L + h_o$

$h_{max} = L_{max} + h_o$

h_p and h_o = empirical factors (see Table 2 for values of h_o/D_o and h_p/D_o).

Let $n = \frac{1}{2}$; $h_o/D_o = 0.5$; $h_p/D_o = 4$.

Since $U_c = 2$ fps at $L = 20$ ft,

$$\frac{2}{\overline{U}_o} = \left(\frac{4}{20+0.5}\right)\left[\frac{1-\left(\frac{20+0.5}{L_{max}+0.5}\right)^2}{1-\left(\frac{4}{L_{max}+0.5}\right)^2}\right]^{\frac{1}{2}} = \left(\frac{4}{20.5}\right)\left[\frac{(L_{max}+0.5)^2-(20.5)^2}{(L_{max}+0.5)^2-(4)^2}\right]^{\frac{1}{2}} \quad \text{-------(4)}$$

The throw, L_{max}, is given by the following equation:

$$L_{max}/D_o = 1.70\, f\, \{[\overline{U}_o^2/gD_o]/[(\overline{T}_o/T_a) - 1]\}^{\frac{1}{2}} \quad \ldots(5)$$

Substituting the following values into this equation:

$D_o = 1$ ft, $f = 0.9$, $T_a = 530$ R, $\overline{T}_o = 602$ R

$$L_{max} = 1.70\ (0.9)\ (\overline{U}_o)\{[1/32.2]/[(602/530) - 1]\}^{\frac{1}{2}}$$

$$L_{max} = 0.732\ \overline{U}_o \quad \ldots\ldots\ldots\ldots\ldots(6)$$

Combining Equations 4 and 6,

$$2/\overline{U}_o = 0.195\ [(0.732\ \overline{U}_o + 0.5)^2 - (20.5)^2/(0.732\ \overline{U}_o + 0.5)^2 - (4)^2]^{\frac{1}{2}}$$

A graphical or cut and trial solution gives:

$\overline{U}_o$ = 29.2 fps.

Summary of Results from Solution:

Estimated velocity at outlet	= 29.2 fps = 1750 fpm
Estimated average temperature at outlet	= 142 F
Design velocity 20 ft below outlet if the floor is not present (20 ft below outlet is actual location of floor)	= 120 fpm
Maximum local temperature at floor*	= 85 F

Conclusions and Recommendations

1. This paper, together with the previous paper on the same subject, gives data describing the behavior of jets of heated air projected vertically downward from a unit-heater into space with remote boundaries. These data, used with regard for the design of equipment and the test conditions employed, may serve as guidance and reference data for designers and investigators interested in developing a rational procedure for predicting the behavior and the performance characteristics of jets of the type investigated.

2. Velocities along the vertical axis of the jets in the region of fully developed flow were satisfactorily represented by an equation of the following form with n between ½ and 1/3:

$$U_c/\overline{U}_o = (h_p/h)\,\{[1 - (h/h_{max})^2]/[1 - (h_p/h_{max})^2]\}^n$$

3. Temperatures along the vertical axis of the jets in the region of fully developed flow were satisfactorily represented by an equation of the following form:

$$(T_c - T_a)/(\overline{T}_o - T_a) = h'p/h'$$

In the vicinity of the bottom of the jet this equation gives values of

$$(T_c - T_a)/(\overline{T}_o - T_a)$$

that are somewhat higher than experimentally determined values and it is not useful for evaluating temperatures below the point on the axis where the velocity is zero.

4. The thermal effect of the jets extended below the bottom of the jets a distance of approximately 1 outlet diameter. Lines of constant temperature elevation above room temperature, drawn in the vicinity of the jets, had the shape of the jets. These lines, remote from the jets, became asymptotic to a horizontal line.

5. Air was entrained over only roughly the first half of the heated air jets. Beyond the approximate midpoint of travel, the mass rate of flow of these jets decreased progressively to a value of zero at the end of the throw. In the case of the isothermal jet, the amount of air entrained per hour per foot of travel was very nearly a constant over the vertical distance investigated.

6. The momentum flux of the isothermal jet decreased slightly with travel. In the case of the heated jets, the decrease of downward momentum flux was substantially greater than the buoyancy force.

7. The exploratory study of jets from a vertical discharge unit-heater of the type used in practice has served the purpose of providing useful guidance data. However, future research should be devoted to jets wherein the factors to be investigated can be isolated and controlled.

8. Means are needed for measuring directly the momentum force of a jet issuing from an outlet. An experimental device for this purpose has been designed and constructed and is now in the process of being tested.

9. In an experimental investigation of jets, it is important that the entire field of influence of the jets be explored.

References

1. ASHVE Research Report No. 1475 — Maximum Downward Travel of Heated Jets from Standard Long Radius ASME Nozzles, by Linn Helander, S. M. Yen and R. E. Crank (ASHVE Transactions, Vol. 59, 1953, p. 241).

2. ASHVE Research Report No. 1511 — Characteristics of Downward Jets of Heated Air from a Vertical Discharge Unit Heater, by Linn Helander, S. M. Yen and L. B. Knee (ASHVE Transactions, Vol. 60, 1954, p. 359).

3. ASHVE Research Report No. 1512 — Computing Temperatures and Velocities in Vertical Jets of Hot or Cold Air, by Alfred Koestel (ASHVE Transactions, Vol. 60, 1954, p. 385).

4. ASHVE Research Report No. 1459 — Exploration of a Chilled Jet, by H. B. Nottage, I. G. Slaby, and W. P. Gojza (ASHVE Transactions, Vol. 58, 1952, p. 357).

*Use of the estimated outlet conditions should result in a floor level temperature that will not exceed 85 F, but may be less than 85 F.

Committee Arranging Cincinnati Events for Coming January Meeting

A. W. Edwards
General Chairman

H. E. Russell
Vice Chairman

Banquet: E. A. Sobolewski, *Chairman;* R. A. Albrecht, Jr., R. H. Endejann, N. O. Kueckels, R. S. Rose, B. F. Turner.

Entertainment: C. P. Krantz, *Chairman;* J. L. Arata, B. R. Byard, W. A. Fennell, E. J. Kramer, J. A. Lamb, W. B. Motz, O. E. Rapp, Pinkney Varble.

Finance: E. W. McNamee, *Chairman;* A. H. Gerdsen, I. B. Helburn, W. H. Junker, T. D. Reiley, G. V. Sutfin.

Ladies: R. C. Beineke, *Chairman;* Mr. & Mrs. H. A. Pillen; Mmes. R. C. Beineke, A. W. Edwards, A. H. Gerdsen, I. Jacobson, C. P. Krantz, E. W. McNamee, T. D. Reiley, H. E. Russell, E. A. Sobolewski, G. V. Sutfin, F. W. Wilson.

Publicity: R. G. Anderson, *Chairman;* L. R. Craig, F. B. DeBra, G. B. Houliston, L. G. Powers, E. J. Richard.

Reception: Mr. & Mrs. F. W. Wilson, *Chairmen;* FOR CINCINNATI CHAPTER — Mr. & Mrs. H. K. Jennings, Mr. & Mrs. Clyde Kessen, Mr. & Mrs. K. B. Little, Mr. & Mrs. W. H. Rieger, Mr. & Mrs. R. S. Rose, Mr. & Mrs. A. J. Staubitz. FOR MIAMI VALLEY CHAPTER — Mr. & Mrs. J. J. Bechtol, Mr. & Mrs. J. M. Schweiger, Mr. & Mrs. C. D. Weaver, Jr.

Sessions: H. W. Moore, *Chairman;* F. J. Bottenhorn, III, E. A. Carsey, J. A. Diehl, F. H. Kiesewetter, F. B. Lienhart, W. H. Rieger, Joe Stockwell.

Transportation: N. A. Frankel, Jr., *Chairman;* Jud Brindle, J. W. Gibbs, I. Jacobson, R. F. McAndrews.

A. H. Gerdsen
Chapter President

H. E. Sproull
Honorary Chairman

T. D. Reiley
Chapter Secretary

Committee Chairmen

H. W. Moore
Sessions

F. W. Wilson
Reception

E. W. McNamee
Finance

N. A. Frankel, Jr.
Transportation

R. C. Beineke
Ladies

C. P. Krantz
Entertainment

R. G. Anderson
Publicity

The Taft Museum on Pike Street, just off Fifth Street, was built over 125 years ago.

On the Banks of the Beautiful Ohio

Society's 62nd Annual Meeting January 23-25

CINCINNATI on the banks of the Ohio River, literally in the center of the United States industrial world, will be host to the Society next January. About 40 percent of the national population is within 350 miles of this city, which makes precision instruments, chemicals, fine paper, soap, machine tools, watches, playing cards and lustrous pottery. It is 600 miles from New York, 240 miles from Detroit, and 700 miles from New Orleans.

In this city on January 23, 1956 at the Sheraton-Gibson Hotel, Pres. J. E. Haines, Minneapolis, Minn. will call to order the 62nd Annual Meeting of the Society. There will be three days of technical sessions, including two symposiums, during which time 16 papers will be presented. In addition, the Committee on Arrangements, under the general chairmanship of A. W. Edwards, is preparing an entertaining program of events which will give everyone an opportunity to enjoy the native Cincinnati atmosphere and hospitality. Full program details will be found on the following page.

For the ladies and those who may have an opportunity to take in some of the local points of interest, particularly if this is a first trip to Cincinnati, a knowledge of the geographical layout of the city may prove helpful.

Vine street is the connecting link of the city. It starts at the river and continues through Cincinnati, the suburbs, and far out into the country. All city streets running in a general north-south direction begin at the river. Vine Street is the dividing line for the east-west streets. Cincinnati has adequate public transportation, and virtually all buses and streets cars come within two blocks of Fountain Square, the city landmark which divides Fifth Street into two lanes between Vine and Walnut Streets.

Kentucky suburbs may be reached by buses or street cars which stop in and around the Dixie Terminal at Fourth and Walnut Streets. Motorists can reach Kentucky by any of the bridges crossing from the downtown area.

Cincinnati today is spread out far beyond the original seven hills of the pioneer settlement. The riverfront extends along two great bends of the Ohio River, and the metropolitan area includes all of Hamilton County, Ohio, and Campbell and Kenton Counties in Kentucky. Although Cincinnati calls its Kentucky neighbors *suburbs*, two of them, Newport and Covington, are among the largest cities in Kentucky.

Make a note of the meeting dates, January 23-25, mail your hotel reservation, arrange for transportation to Cincinnati and make your reservations for the Special Events using the forms supplied. The Committee on Arrangements and the Cincinnati Chapter members want you to Come to Cincinnati for the Society's 62nd Annual Meeting.

PROGRAM—62nd ANNUAL MEETING

American Society of Heating and Air-Conditioning Engineers

Sheraton-Gibson Hotel, Cincinnati, Ohio

January 23-25, 1956

Saturday — January 21

10:00 a.m. Executive Committee
1:30 p.m. Finance Committee
1:30 p.m. Public Relations Committee
2:30 p.m. Research Executive Committee
3:00 p.m. Chapter Relations Committee

Sunday — January 22

9:30 a.m. Council Meeting
10:00 a.m. Committee on Research
2:00 p.m. TAC Meetings
3-5 p.m. Reception and Tea

Monday — January 23

10:00 a.m. FIRST SESSION (*Ballroom*)
Call to Order — John E. Haines, President
Greetings by A. H. Gerdsen, President, Cincinnati Chapter
Report of President — John E. Haines
Report of Council — A. V. Hutchinson
Report of Treasurer — E. R. Queer
Report of Committee on Research — B. H. Jennings
Noise Production and Damping in Water Piping, by W. L. Rogers

12:15 p.m. WELCOME LUNCHEON (*Roof*)
Chairman: A. W. Edwards
Speaker: F. W. Giesel, Business Manager, Cincinnati Post
Subject: Forward — A Look at Tomorrow

1:00 p.m. CINERAMA

2:00 p.m. SECOND SESSION (*Ballroom*)
Call to Order — John W. James, Vice President
Performance of Covered Hot Water Floor Panels, Part I — Thermal Characteristics, by E. L. Sartain and W. S. Harris
Thermal Design of Warm Water Ceiling Panels, by L. F. Schutrum, C. M. Humphreys and G. V. Parmelee
Heat Gain Through Glass Skylight Fenestrations, by D. J. Vild and G. V. Parmelee

2:30 p.m. THIRD SESSION (*Roof*)
Call to Order — E. R. Queer, Treasurer
Moisture in Transient Heat Flow, by K. R. Solvason
Characteristics of Downward Jets from a Vertical Discharge Unit Heater, by S. M. Yen, Linn Helander and L. B. Knee
Resistance of Rectangular Divided-Flow Fittings, by L. G. Miller, C. H. Pesterfield and R. J. Waalkes

6:45 p.m. KENTUCKY PARTY at Beverly Hills Country Club
Buses leave Hotel from 6:00 to 6:15 p.m.

Tuesday — January 24

9:30 a.m. FOURTH SESSION (*Ballroom*)
Call to Order — John E. Haines, President
Amendments to By-Laws
Report of Inspectors of Election
John Everetts, Jr., Vice Chairman
Evaluation of Equipment Noise, by H. C. Hardy and D. E. Bishop
Electric Analogue Studies of Single Wall Sections, by Harry Buchberg
Electric Analogger Analysis of a Cooled Structure Complex, by C. F. Kayan

10:00 a.m. FIFTH SESSION (*Roof*)
Call to Order — John W. James, Vice President
M. K. Fahnestock, Vice Chairman
Index for Evaluating Heat Stress in Terms of Resulting Physiological Strains, by H. S. Belding and T. F. Hatch
Body Evaporation During Short Exposures to Various Temperatures, Humidities, Pressures and Mass Velocities, by J. W. McCutchan
Humidity Effects on the Odor Problem, by R. L. Kuehner

10:30 a.m. Ladies' City Trip and Luncheon
1:30 p.m. Chapters Conference Committee
2:00 p.m. Inspection Trips
7:00 p.m. Past Presidents' Dinner

Wednesday — January 25

9:30 a.m. SIXTH SESSION (*Ballroom*)
Call to Order — P. B. Gordon, Vice President
Elements of Dual-Duct Design and Performance, by N. S. Shataloff
Branch Fitting Performance at High Velocity, by C. M. Ashley, S. F. Gilman and R. A. Church
Self-Actuated Room Control from High Speed Air, by E. F. Snyder, Jr.

12:30 p.m. Ladies' Style Show and Luncheon

2:00 p.m. SEVENTH SESSION (*Ballroom*)
Call to Order — P. B. Gordon, Vice President
High Velocity Air Distribution Symposium
Duct Design — M. W. Wilson
Economics, Costs *vs.* Velocity — John Everetts, Jr.
Fan and Air Noises — C. W. Lemmerman
Duct Construction — K. A. J. Monier
Field Testing — R. D. Tutt
Pres. John E. Haines presiding
Report of Committee on Resolutions
Unfinished Business
New Business
Recess

2:00 p.m. EIGHTH SESSION (*Roof*)
Call to Order — John E. Haines, President
Air Pollution Symposium
C. H. Pesterfield, Vice Chairman
Health Aspects — Arthur Stern
Smog — Gordon Larsen
Regulations — Harry Ballman
Cleaning — J. W. May
Practical Approach — Charles Gruber
Enforcement — J. H. Carter

4:00 p.m. Nominating Committee Meeting
6:30 p.m. Social Hour
7:00 p.m. ANNUAL BANQUET (*Roof*)
Toastmaster: C. P. Krantz
Introductions and Installation of 1956 Officers
Presentation of Past President's Award
Presentation of F. Paul Anderson Medal
Adjournment
Music for Dancing

Thursday — January 26

9:30 a.m. Council Meeting
10:00 a.m. Committee on Research

THE PRESIDENT'S PAGE

In the Next Half Century—What?

A television station which will open its new building about the first of next year will incorporate in the structure a metal box marked "To Be Opened 2000 A.D.". The presidents of a number of large corporations were asked to speculate as to what the year 2000 would hold so that their predictions could be placed in this metal box.

Many of us will not be here in 2000 A.D., but our children and grandchildren will be. Have you ever wondered how they will live and work and play?

If you had looked forward forty-five years in 1910 would you have predicted atomic energy, radio broadcasting, television, automotive transportation, jet planes for passenger transportation, and hundreds of other similar developments.

Here are a few probabilities for 2000 A.D., in only a few fields.

Transportation

Except for short distances, all travel can be expected to be by air in ships which will resemble only slightly, if at all, the airplanes of today. Automobiles, trucks, and buses powered exclusively by atomic energy will be entirely different in appearance, more efficient, and radar will be available to automatically prevent accidents. Excursions to the moon by human beings in space ships should be commonplace.

Automation

The modern factory at the end of the century should make use of very little human labor what with automatic machines to produce every known product. And these machines will be operated and maintained by skilled engineers especially trained for their work. A factory which attempts to use unskilled human labor will be unable to compete.

Although automation is still in its infancy today, few of us realize that the paper mill and the oil refinery have used automation for years. Recent studies show that certain of these plants must even now be operated automatically with skilled engineers in attendance, and cannot be designed for traditional manual operation.

Medicine

The great strides made in medicine during the past forty-five years indicate that even greater developments lie ahead. Diseases such as tuberculosis, polio, arthritis, cancer, diabetes, rheumatic fever, and bursitis might be completely eliminated and even the common cold might be under control though still with us.

Because of the elimination of so many ailments, and the existence of greater knowledge, fewer physicians and surgeons as we know them today may be required, but research in this field will continue at an accelerated rate — particularly on mental diseases.

Air Conditioning

All modern homes, commercial buildings, and factories will be completely air conditioned and this conditioning will include the elimination of odor and bacteria and the control of radiant effects as well as the control of temperature, humidity, air cleanliness, and air distribution.

Air conditioning will be greatly responsible for the huge changes which will come about in the design and construction of all types of buildings. They will be more functional, have fewer and smaller windows, and be relatively less expensive to build.

Heating will be provided largely if not entirely by atomic and solar energy; cooling by a new principle eliminating all moving parts; and air distribution by the creation of air differentials rather than by air compressing devices as we know them today.

Because of the tremendous increase in the demand for air conditioning, the air conditioning industry might easily have reached an annual volume of twenty to thirty billion dollars.

Our Society in 2000 A.D.

Although air conditioning has been in use about fifty years, there are still many fundamentals to be learned only through guided research. In this, our Society can be expected during the next forty-five years to continue to play its already highly important part. We should be able to confidently expect an increase in the Society's membership to more than 30,000, and perhaps to 50,000, with from 150 to 200 chapters by the end of the century.

J. E. Harris

President

American Society of Heating and Air-Conditioning Engineers

Plant and Animal Husbandry

By A. J. Hess*, Los Angeles, Calif.

Control of the environment of animals and plants is of increasing importance to mankind. Those of us engaged in the air conditioning industry are familiar with the control of the environment of one animal — the human being. Much effort by our Society is given over to study and work on this one phase of air conditioning.

In recent years a considerable amount of work has been done in determining the values of controlled atmospheres for living organisms other than human beings, and much economic justification has been found for this use of air conditioning. This fact alone should warrant our support of research aimed at establishing needed basic data.

Animals Thrive With Air Conditioning

In the case of animals there is no great difference in the basic rules of design as compared to the human animal. Research work has established that better quality meat and dairy products can be produced with less food consumption under controlled environmental conditions than can be obtained by using the varied, haphazard and unpredictable conditions supplied by nature. Control of high temperatures can limit the normal high mortality associated with excessive summer temperatures especially in the case of poultry. Warm environment in the winter decreases food consumption since the animal is not required to generate the excess heat required to keep warm.

Research has also established that many animals are inefficient when living in enclosures without proper ventilation. Wastes from

animals generate atmospheric pollution that reduces the well-being of animals and therefore ventilation is an important part of environmental control.

Growing Plants Need Controlled Atmospheres

Plants also grow and produce better in controlled atmospheres for much the same reasons as animals. As a matter of fact the atmosphere surrounding a plant is more important to plant growth than the atmosphere surrounding animals is to animal growth because the CO_2 in the atmosphere is the food the plant lives on. Contrary to most agricultural thinking, the plant gets practically all of its food from the air and not from the ground. The ground merely supplies moisture, minerals and other supplements. Indications are that controlled atmospheres for growing plants increase markedly the efficiency of photosynthesis and probably ultimately provide us with the simplest and most economical method of utilizing the only continuing and inexhaustible source of energy available to us, namely, the sun.

Controlled environment for growing plants also offers a way of protecting the plants from wayward pollens and thus enables seed growers to control plant strains much more accurately than is now possible in open fields. Enough research has been done to assure better plants, and to eliminate seasonal limitations on production, when controlled environments are used. Some luxury crops are now grown under air conditioning.

Aims of the Advisory Committee

The TAC on Plant and Animal Husbandry has been set up to advise on projects dealing with this new and important phase of air conditioning. We intend to encourage Society participation in such research and to obtain for the use of the general public as much useful information as we can find. One project on plant environment has been completed. Much more needs to be done, but we can only move slowly due to lack of funds. Facilities and manpower are available to us when, and if, we obtain funds.

Organization of this TAC is difficult for many of the members must be botanists, physiologists, biochemists and others who are not engineers and hence not members of the Society.

We are endeavoring to find a satisfactory method of procedure and suggestions will be welcomed by the present members of the TAC.

*Chairman, ASHAE Technical Advisory Committee on Plant and Animal Husbandry.

Journal Section

Summary of Chapter Meetings*

• *ARIZONA*: The test project on residential air conditioning at Austin, Tex., was the subject of the guest speaker at the September meeting. Pres. W. A. Biddle, who presided at the meeting, introduced the speaker, C. W. Nessell, heating industry consultant, Minneapolis-Honeywell Regulator Co., Mount Prospect, Ill. Mr. Nessell, who was in charge of the *National Warm Air Heating and Air Conditioning Association's* program at Austin, commented on the performance of the cooling systems in the 22 houses included in the air-conditioned village. At the conclusion of his talk, he replied to questions from the floor. Attendance 48. Attendance ratio 0.56.

• *ATLANTA*: The proposed heating, ventilating and air-conditioning code for the City of Atlanta was the subject of a panel discussion featured at the September meeting. W. P. West, program chairman, presented the program, and S. W. Boyd acted as panel moderator.

Pres. T. A. Barrow presided at the meeting and announced his standing committee selections for the 1955-56 season. He named the following committee chairmen: *Program*—W. P. West; *Code*—S. W. Boyd; *House*—J. P. McLaney; *Membership*—W. J. McKinney; *Publicity*—G. H. Meier, Jr.; *Research*—W. M. Garrard; and *Finance*—J. S. Edgar. President Barrow also appointed a committee, with J. M. Lazenby as chairman, to select a member and alternate member of the ASHAE Chapters Conference Committee. Attendance 77. Attendance ratio 0.46.

• *BLUEGRASS*: At the September meeting a letter was read welcoming Western Massachusetts as the 61st chapter of the Society, which made the Bluegrass Chapter, number 60, no longer the baby of ASHAE chapters.

Plans were outlined for the program for the coming year, and the following committee chairmen were appointed: *Program*—W. J. Killian; *Membership*—K. P. Vinsel, Jr.; *Attendance*—E. C. Arenz; *Entertainment*—E. W. Neel; and *Publicity*—R. F. Logsdon.

The officers who will serve for the 1955-56 year are: *President*—W. M. Pace; *Vice President*—W. J. Killian; *Secretary*—R. B. Duggan; *Treasurer*—O. J. Hill; *Board of Governors*—J. W. May, F. E. Hanson, Mr. Arenz, A. E. Handmaker, and E. G. Zanone.

• *CONNECTICUT*: A panel discussion on *Water Saving Equipment for Air Conditioning* was held at the September meeting with P. D. Harrigan as moderator. Speakers and their subjects of specialization were as follows: E. W. Ward, Carrier Corp., Syracuse, N.Y.—*Evaporative Condensers;* J. D. Loveley, Chrysler Airtemp, Division of Chrysler Corp., Dayton, Ohio—*Air-Cooled Condensers;* and C. W. Millson, Acme Industries, Inc., Jackson, Mich.—*Cooling Towers.*

At this first meeting of the season, Vice Pres. Walter Heywood presided. Attendance 80.

• *KANSAS*: *New Things Possible with Electronic Control* was the subject of the September guest speaker, C. D. Adams, Jr., branch sales manager, Minneapolis-Honeywell Regulator Co., Houston, Tex. Mr. Adams was introduced to his audience by Vice Pres. A. B. Newton. Pres. Charles Yoe presided at the meeting.

Following reports by H. M. Skalla, treasurer, and R. F. Bauer, chairman, nominating committee, new officers for 1955-56 were elected by written ballot: *President*—A. B. Newton; *Vice President*—H. M. Skalla; *Secretary*—T. L. Roberts; and *Treasurer*—A. P. Sullivan. Attendance 22.

• *KANSAS CITY*: The members' response to a talk on automobile air conditioning presented at the September meeting indicated great interest in the subject. In his timely address entitled *The Air Conditioning Equipment in Your New Car*, D. C. McCoy, general sales, Frigidaire Division, General Motors Corp., Dayton, Ohio, covered automobile air conditioning, the problems, and their solution. R. M. Spencer introduced the speaker.

Pres. A. S. Hurt, Jr., presided at the meeting. Each of the standing committee chairmen reported on the aims and activities of his committee. Thirty-six wives attended this first business meeting to which they were invited, and they appeared to enjoy themselves immensely. Attendance 140. Attendance ratio 0.39.

• *NORTH TEXAS*: The guest speaker at the September meeting, Robert Hinich, manager, water conditioning department, Allis-Chalmers Manufacturing Co., Milwaukee, Wis., enjoyed an attentive audience. Mr. Hinich selected a hypothetical installation consisting of a 1000-ton air-conditioning plant, utilizing a steam turbine drive compressor, high pressure boiler plant, cooling tower and chilled water circulating system as a means to illustrate the various problems of water treatment. In a systematic and interesting manner, Mr. Hinich described the problems of water hardness and alkalinity which might be encountered in the use of typical well water and city water for make-up purposes in this type of installation. His discussion included zeolite water softening, deaerator heaters and chemical treatment.

• *NORTHEASTERN OKLAHOMA*: Pres. J. T. McKinney presided at the September meeting, opening a new season. The mail accumulated during the summer months was read by Secy. G. A. McCune.

Talks by two Tulsa industrial engineers completed the program. John Abernathy, Oklahoma Natural Gas Co., spoke on *Rates of the Tulsa Gas Utility* and J. D. Shaw, Public Service Co. of Oklahoma, discussed *The Rates of Public Service Co. of Tulsa.* Attendance 20. Attendance ratio 0.50.

• *SOUTH CAROLINA*: Films taken at the June outing were shown at the September meeting by R. K. Demarest, Jr., with commentary furnished by F. A. Bailey, Jr.

R. F. Donovan introduced the guest speaker, P. F. O'Neal, General Electric Co., Bloomfield, N. J. Mr. O'Neal discussed *The Heat Pump and Its Applications* and presented a series of slides indicating operating principles, construction and application of the air-to-air heat pump. Following the talk, Mr. Bailey presented the speaker with a copy of *Willis Haviland Carrier, Father of Air Conditioning,* by Margaret Ingels. Pres. R. K. Rouse presided. Attendance 54. Attendance ratio 0.49.

• *SOUTH TEXAS*: *Be Comfortable and Relax* advised W. S. Miller, York Corp., York, Pa., speaking at the September meeting. Mr. Miller related the experience of the various manufacturers participating in the Austin Village and mentioned many interesting points concerning residential air conditioning. According to a new plan devised by J. C. Lewis, program committee chairman, a past president, H. W. Broadwell, introduced the speaker. Pres. F. M. Neil presided at the meeting. Attendance 70.

• *SOUTHERN CALIFORNIA*: The *Austin Project,* which was conducted jointly by the *National Homebuilders Association* and the *National Warm Air Heating and Air Conditioning Association* on 22 houses in the Austin, Tex., area, was the topic presented at the September meeting by C. W. Nessell, heating industry consultant, Minneapolis-Honeywell Regulator Co., Mount Prospect, Ill. Mr. Nessell discussed problematic sources of humidity, such as dishwashers, cooking, and water underneath the house caused by yard sprinkling. He also covered some installation and maintenance costs, and factors involved in analyzing any cost study. The speaker not only gave valuable information, but also added a touch of humor which held the group's interest. G. D. Lord, program chairman, introduced Mr. Nessell to the audience.

H. B. Nottage, chairman, codes and standards committee, reported on that committee's activities with respect to fire protection. Pres. J. L. McCullough presided. Attendance 73.

*Note: The attendance ratios shown represent the membership attendance divided by the chapter membership. These ratios will be useful as a partial indication of interest shown by local chapter members in various types of subjects programmed by the various chapters and may be useful in deciding on subjects for chapter meetings.

Journal Section — Candidates for Membership

The Society's By-Laws require that all applications for membership or advancement are to be sent to the Executive Secretary and the names of applicants and their references shall be printed in the next issue of the JOURNAL of the Society, or mailed to all members. When the replies are received from references the Candidate's application shall be submitted to and acted upon by the Admission and Advancement Committee as soon as possible.

When the Admission and Advancement Committee has acted favorably upon a Candidate's application and assigned his grade, the Council shall confirm the election of the proposed Candidate for membership. During the past month there have been 65 applications for membership, including 3 students, 1 reinstatement; in addition 19 advancements have been received. The names of these men and their sponsors are published in the following list.

Members are requested to scrutinize the list with care. The Admission and Advancement Committee, and in turn, the Council, urge members to assume their share of responsibility of receiving these candidates into membership by advising the Executive Secretary promptly of any whose eligibility for membership is in any way questioned.

All correspondence in regard to such matters is strictly confidential, and is solely for the good of the Society, which it is the duty of every member to promote.

Unless objection is made by some member by November 30, 1955, these candidates will be voted upon by the Council. Those elected to membership will be notified by the Executive Secretary immediately after election.

Note: †Reinstatement. *Non-member. △Advancement.

Arizona

SOMMER, HANS, Dist. Mgr., Minneapolis-Honeywell Regulator Co., Phoenix. REFERENCES: W. J. Biggar, J. B. Hoaglund, J. S. Locke, C. T. Snider.

California

CLYDE, E. N., Chief Engr., Trade-Wind Motorfans, Inc., Rivera. REFERENCES: S. F. Duncan, E. P. Gerich, G. F. Sleight, E. K. Springer*.

LINFORD, J. A., Owner, Linford Air & Refrigeration Co., Oakland. REFERENCES: K. F. Baldwin, R. B. Holland, J. E. Murray, W. P. Scott, Jr*.

MIX, G. C., Vice Pres., Bronson Fan Mfg. Corp., Los Angeles. REFERENCES: E. P. Gerich, G. D. Lord, R. J. Petersen, C. V. Smith.

Colorado

CALLAHAN, A. B., JR., Br. Mgr., E. K. Campbell Co., Denver. REFERENCES: N. H. Brickham, R. L. Byus, E. K. Campbell, R. P. Campbell.

△PEARSALL, D. D., Owner, Mfrs. Repr., Heating & Air Conditioning Equipment, Denver. REFERENCES: J. F. Cipra, K. R. Warshauer, J. R. Wilson, H. L. Wray.

Florida

BAUERLEIN, E. J., JR., Cadet Engr., Florida Power Corp., St. Petersburg. REFERENCES: C. W. Ailstock*, R. H. Giedd*, G. C. Hall, C. M. Wentz.

Georgia

JACKSON, W. W., Sales Engr., Johnson Service Co., Atlanta. REFERENCES: T. A. Barrow, J. M. Lazenby, W. P. West, K. A. Wright.

RAST, W. W., Sales Engr., Raymond Distributing Co., Atlanta. REFERENCES: T. A. Barrow, W. L. Hunken, G. H. Meier, Charles Sockwell.

YOPP, H. T., Comm. Sales Engrg. Specialist, Georgia Power Co., Atlanta. REFERENCES: George Holden, Jr., D. F. Lindstrom, J. C. Thompson, R. W. Wages.

Illinois

CARLSON, K. G., Engr.-Draftsman, Samuel R. Lewis & Assocs., Chicago. REFERENCES: E. P. Heckel, S. R. Lewis, S. I. Rottmayer, F. X. Thale.

△DAVID, J. M., Pres., The Lewie David Co., Sullivan. REFERENCES: R. Archibald*, Ike Eichenberger*, S. Konzo, Mac McKenzie*.

LEWIS, J. R., Sales Engr., American Blower Corp., Rock Island. REFERENCES: R. L. Graham, J. F. Hillery, R. J. Lavalley*, F. B. Morse.

SHELLEY, WILLIAM, Sales Engr., York-Shipley, Chicago. REFERENCES: J. S. Kearney, Jack Lapp, E. L. Mitchell, E. R. Teske.

△THYGERSON, R. J., JR., Engr., Chicago Conditionaire Co., Chicago. REFERENCES: H. G. Gragg, W. L. Long, L. H. Streb, H. H. Van Epps.

†WILLIAMS, E. J., Sr. Mech. Engr., Abbott Laboratories, North Chicago. REFERENCES: H. G. Gragg, A. T. Jorn, P. J. Marschall, W. S. Maxim.

Louisiana

MOORE, R. W., JR., Serv. Mgr.-Design, Beaullieu Air Conditioning & Heating Co., Lafayette. REFERENCES: F. D. Beaullieu, III, A. C. Chappuis*, R. E. Jenkins, L. J. Langlois.

TROXLER, J. R., Asst. Prof., Southwestern Louisiana Institute, Lafayette. REFERENCES: F. D. Beaullieu, III, A. C. Chappuis*, R. E. Jenkins, L. J. Langlois.

Maryland

LIPPINCOTT, W. S., Design Engr., James Posey & Assocs., Baltimore. REFERENCES: W. C. Hossfeld, R. L. Hughes, A. K. Kroft, James Posey.

REESE, G. R., Estimator-Engr., The George A. Peters Co., Baltimore. REFERENCES: G. M. Baldwin, G. F. Gist, Jr., E. H. Taze, J. K. Wolford.

Massachusetts

WALLANS, SAMUEL, Owner-Sales Engr., Sam Wallans Co., West Springfield. REFERENCES: R. E. Cross, Edward Fallon*, Jack Lipman*, J. E. Reed.

Michigan

△HUNTER, P. D., Mech. Engr., State of Michigan Dept. of Administration Building Div., Lansing. REFERENCES: R. R. Kingscott, A. N. Langius*, C. H. Pesterfield, R. J. Waalkes.

PANZICA, N. J., Proj. Engr., Claude B. Schneible Co., Detroit. REFERENCES: N. B. Elliott, J. B. Freeman, R. B. Hartupee*, A. S. Lundy.

Minnesota

△WARNER, R. E., Sales Engr., Uhl Co., Inc., Minneapolis. REFERENCES: A. B. Algren, R. L. Bloom, E. J. Burns, L. D. Freedland.

New Jersey

△COHEN, SIDNEY, Gen. Mgr., Totowa Metal Fabricator Co., Totowa Boro. REFERENCES: R. L. Dobrin, E. H. Fiigon, C. L. Pratt, F. J. Quinn*.

New Mexico

BREESE, J. L., Partner, Breese & Jensen, Santa Fe. REFERENCES: J. K. James, L. E. Meyer, R. N. McDonald, H. F. Munn.

GLASSMIRE, S. H., Designer, Engrg. Dept., Los Alamos Scientific Laboratory, Los Alamos. REFERENCES: F. H. Bridgers, J. B. Graham, R. L. Shehan*, R. J. Walker.

JENSEN, R. E., Partner, Breese & Jensen, Santa Fe. REFERENCES: W. B. Herin*, H. F. Munn, A. E. Rhodes*, R. C. Van De Weghe.

RUIZ, J. A., Owner, Ruiz Plumbing Co., Las Cruces. REFERENCES: J. H. Brooks, G. H. Jackson, J. O. LeBeau, Jr., Eddy Shores.

New York

△BOLLAERT, ROLAND, Sales Engr., Johnson Service Co., New York. REFERENCES: J. L. Best, J. E. Duval, Jr., J. H. Herbst, J. S. O'Gorman, Jr.

MACH, JOSEPH, Sales Engr., Landers Equipment Co., Buffalo. REFERENCES: J. P. Guerra, J. J. Landers, J. M. Quackenbush, J. E. Reed.

△MORTON, H. J., Asst., William J. Goff & Son, Syracuse. REFERENCES: C. R. Acheson, A. L. Jones, F. E. Krell, K. T. Sprague.

PFEIFFER, I. R., Sales Engr., Minneapolis-Honeywell Regulator Co., Long Island City. REFERENCES: Ernst Graber, C. S. Koehler, H. N. Seelinger, A. L. Zigas.

RICE, R. J., Chief Engr., Raymond J. Rice Engineers, New York. REFERENCES: J. L. Altieri, Arthur Benjamin, Ian Grad, M. A. Haber.

SHIM, FREDERICK, Appl. Engr., Carrier Corp., Syracuse. REFERENCES: O. W. Armspach, R. S. Arnold, J. H. Carpenter, R. A. Church.

North Carolina

△EAKES, M. L., Vice Pres., Conditioned Air, Inc., Greensboro. REFERENCES: C. Z. Adams, W. D. Graham, Jr., H. B. Hoffman, Sr., S. T. Oliver.

△SULLIVAN, C. S., Secy., W. H. Sullivan Co., Inc., Greensboro. REFERENCES: C. Z. Adams, W. D. Graham, Jr., G. B. Rottman, L. L. Vaughan.

Ohio

△BALLARD, E. E., JR., Br. Mgr., The Trane Co., Canton. REFERENCES: Richard Dykes*, W. E. Eynon, Amos Laux*, William Mitchell*.

MCCLOSKEY, F. G., Pres., Acro Manufacturing Co., Controls Div., Columbus. REFERENCES: A. F. McGovern, E. A. Nirman, Jr., Ollie Olsen*, J. J. Trimble.

RAMLOW, D. E., Filter Factory Mgr., Owens-Corning Fiberglas Corp., Newark. REFERENCES: R. B. Crepps, M. E. Jacoby, D. M. Long, W. B. Watterson.

WYCKOFF, P. W., Chief Engr., Airtemp Div., Chrysler Corp., Dayton. REFERENCES: J. C. Davidson, R. A. Gonzalez, J. D. Loveley, R. B. Stotz.

Oklahoma

△VON TUNGELN, L. L., Engr., William J. Collins, Jr., Cons. Engr., Oklahoma City. REFERENCES: W. J. Collins, Jr., E. F. Dawson, G. E. Ervin, F. X. Loeffler, Jr.

Oregon

EVANS, E. P., Repr., Brod & McClung, Portland. REFERENCES: Walter Hanthorn, Edwin Hunt, C. F. Ingham, T. H. McClung.

JOHNSON, J. A., Owner, Northwest Plumbing & Heating Co., Portland. REFERENCES: A. H. Bohren, W. B. Hayes, W. R. Norte, J. W. Wallace, Jr.

KAUFMAN, A. W., Gen. Mgr., Air Filter Sales & Service, Portland. REFERENCES: Edwin Hunt, C. F. Ingham, T. H. McClung, L. F. Miller.

KEMPER, V. A., Contract Mgr., The E. J. Bartells Co., Portland. REFERENCES: D. L. Benz, J. P. McDermott, H. H. Nesbitt, R. L. Schroeder.

Pennsylvania

TURNER, J. W., Consultant, National-U.S. Radiator Corp., Johnstown. REFERENCES: R. L. Evans, L. N. Hunter, John W. James, H. H. Wright.

South Carolina

△MCKAUGHAN, C. C., Sales Engr., Johnson Service Co., Greenville. REFERENCES: H. B. Hoffman, C. A. McKeeman, L. L. Vaughan, Joe Wheeler, Jr.

South Dakota

△ROBY, R. L., Cons. Engr., Mitchell. REFERENCES: Lee Beuttler*, Earl Dake*, W. J. Dixon*, E. R. Stensaas*.

Texas

BROOKS, J. H., Engr., Peeler, Hansen, Wilson Co., El Paso. REFERENCES: G. H. Jackson, J. O. LeBeau, Jr., G. M. Sebree, Eddy Shores.

COOKE, W. S., JR., Sales Engr., Boyd Engineering Co., Inc., El Paso. REFERENCES: W. E. Boyd*, W. A. Byars, Jr., E. S. Jaggars, J. A. True.

COX, E. A. L., JR., Estimating Engr., Electrical & Mechanical Supply Co., Inc., El Paso. REFERENCES: W. F. Burnett, W. A. Byars, Jr., A. E. Hatch*, W. L. Lashley.

FAHL, J. T., Sales Repr., Crane Co., El Paso. REFERENCES: W. S. Cooke, Jr., J. N. Irby, G. H. Jackson, J. O. LeBeau, Jr.

GIBSON, R. O., Partner, Metropolitan Plumbing Co., El Paso. REFERENCES: N. D. Goodwin, J. N. Irby, G. H. Jackson, J. O. LeBeau, Jr.

△GILMORE, C. F., Engr., Zumwalt & Vinther, Cons. Engrs., Dallas. REFERENCES: T. H. Anspacher, R. O. Burns, W. E. Frost, G. A. Linskie.

△HERNDON, C. I., Sales Engr., Deansteel Products, San Antonio. REFERENCES: L. A. Ingle, Jr., F. W. Karbach, A. J. Rummel, W. E. Wallis.

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LEBEAU, J. O., JR., Sr. Sales Engr., Minneapolis-Honeywell Regulator Co., El Paso. REFERENCES: J. H. Brooks, W. A. Byars, Jr., J. N. Irby, G. H. Jackson.

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PALKOVIC, A. J., Sales Engr., M & M Refrigeration & Supply Co., El Paso. REFERENCES: J. H. Brooks, G. H. Jackson, J. O. LeBeau, Jr., Eddy Shores.

POE, H. L., Engr., Boyd Engineering Co., El Paso. REFERENCES: E. S. Jaggars, Eddy Shores, Howard Taylor*, George Trainer*.

SHORES, EDDY, Pres., Peeler, Hansen, Wilson Co., El Paso. REFERENCES: W. L. Beale, J. M. Huff, G. H. Jackson, G. M. Sebree.

SHURLEY, J. K., Engr., Southwestern Sheet Metal Works, El Paso. REFERENCES: J. H. Brooks, G. H. Jackson, J. O. LeBeau, Jr., Eddy Shores.

TAYLOR, E. J., Sheetmetal Journeyman, Central Sheet Metal Co., San Antonio. REFERENCES: R. A. Boggs*, H. I. Hoffman, Edward Robertson*, R. A. Simpkins*.

TRUE, J. A., Resident Engr., Landauer and Shafer, El Paso. REFERENCES: W. A. Byars, Jr., J. N. Irby, L. L. Landauer, W. J. McCormick*.

Washington

MORRIS, A. A., Sr. Engr., Leo A. Daly and Assocs., Seattle. REFERENCES: R. G. Alvine*, H. P. Brehm, M. F. Stober, C. L. Thompson*.

Wisconsin

HARRIS, H. M., Western Dist. Mgr., Mueller Climatrol Div. of Worthington Corp., Milwaukee. REFERENCES: R. F. Bauer, N. E. Hill, F. J. Nunlist, O. J. Ress.

Journal Section

Canada

CATHERWOOD, V. I., Htg. Engr., Western Supplies, Ltd., Edmonton, Alta. REFERENCES: William Graham*, J. S. Michener, D. A. Peckinpaugh, H. M. Treleaven.

MACBRIDE, J. F., Sales Engr., Johnson Temperature Regulating Co. of Canada, Edmonton, Alta. REFERENCES: B. J. Horsburgh, R. A. Malcolm, R. G. Proudfoot, R. A. Williams.

MACKAY, D. E. A., Secy.-Treas., Crowther, MacKay & Assocs., Ltd., Edmonton, Alta. REFERENCES: E. J. Crowther*, E. K. Cumming, G. H. Galbraith, A. N. Nordstrom.

MALCOLM, C. S., Assoc., S. M. Peterkin Co., Ltd., Toronto, Ont. REFERENCES: W. H. Bonus, J. H. Fox, S. M. Peterkin, D. A. Stott.

△MICHENER, J. S., Sales Engr., Trane Co. of Canada, Edmonton, Alta. REFERENCES: D. L. Angus, M. C. Bailey, J. H. Fox, D. A. Peckinpaugh.

PIRRIE, ALEXANDER, Vice Pres., Standard Sanitary & Dominion Radiator, Ltd., Toronto, Ont. REFERENCES: Jack Jenkinson, William Philip, A. G. Reed, H. R. Roth.

RATCLIFF, R. G., Sales Mgr., E. H. Price, Ltd., Edmonton, Alta. REFERENCES: D. J. Bisset, G. J. Mitchell, E. H. Price, R. A. Williams.

SIEMENS, KORNELIUS, Cons. Engr., Edmonton, Alta. REFERENCES: P. M. Butler, Roy Emery*, A. F. Rayner*, R. A. Williams.

SINGH, SATINDER, Engr., Wiggs, Walford, Frost & Lindsay, Toronto, Ont. REFERENCES: L. C. DeGroot, K. E. Evans, M. R. Paulsen, L. C. A. Walford.

Australia

MITCHELL, K. S., Design Engr., W. E. Bassett and Assocs., Sydney. REFERENCES: A. E. Atherton, K. A. Bowman, G. I. Davey, T. A. Roseby.

Norway

△LOTHE, J. A., Cons. Engr., Haugesund. REFERENCES: H. M. Black*, Sven Sandved*, Reidar Ronningen*, Jakob Vabo*.

South Africa

△BLASE, T. F., Contracts Mgr., Airco Engineering, Ltd., Durban. REFERENCES: G. E. Brink, R. J. S. Caldwell, C. A. Christierson, Alexander Sibert.

Turkey

TURKER, TURHAN, Chief Mech. Engr., Wilson-Ammann & Whitney-Husted, Ankara. REFERENCES: Mike Flanikan*, A. M. Hill*, W. O'Rourke*, Adrian Wilson*.

Students

UNIVERSITY OF ILLINOIS, Champaign, Ill. CERTIFIED BY: J. R. Carroll.
BODETT, P. C.
CLEMENT, R. E.

WASHINGTON UNIVERSITY, St. Louis, Mo. CERTIFIED BY: C. J. Keppenhorn*.
ASHLOCK, F. B.

OBITUARIES

W. E. GILLHAM, FORMER SOCIETY TREASURER, DIES AT 77

Walter E. Gillham, who served as treasurer of the Society from 1926-29, died at the Research Hospital in Kansas City, Mo., on September 7, 1955. Mr. Gillham, a widely known consulting engineer in the Kansas City area, also was elected a member of the Society's Council for a three-year

Walter E. Gillham

term, 1924-26. He was honored by Life Membership six years ago.

During his Council term, Mr. Gillham served as a member of the Membership Committee, 1924-28, acting as chairman from 1926-27. In 1925 he also served on the Committee to Draft a Code for the Guidance of Membership Committees. He was a member of the Research Endowment Fund Committee in 1928 and of the Executive Committee in 1929.

A charter member of the Kansas City Chapter, he assisted in its organization and chartering in 1917. He was elected president of the Chapter for 1923, having previously served as vice president and as a member of the board of governors. During his presidency, Kansas City was host to the Society for the 1924 Semi-Annual Meeting.

Born on a farm in Jackson County, Mo., on June 9, 1878, Mr. Gillham attended the Manual Training High School in Kansas City. He gained his first experience and training in the art of heating and ventilating school buildings in the office of the chief engineer for the Kansas City Board of Education. From 1903-08 he worked with Lewis & Kitchen in Kansas City and Chicago, specializing in the heating and ventilating of school buildings. He was then connected with MacMahon Co., Kansas City, furthering his experience in steam heating and plumbing.

Mr. Gillham opened his own engineering office in 1910 and, except for a brief period during each world war, maintained that office, designing the mechanical work on various projects in Kansas City and the surrounding territory. He designed the power plant and heating and ventilating system for St. Joseph Hospital in 1914, and was requested by the same architectural firm to install an air-conditioning system in that hospital thirty-five years later. He was also employed as a consultant on the Nelson Gallery of Art, the Bell Telephone Building and the Jackson County Courthouse. In 1940 he was appointed as a member of a committee to draw up a new building code for Kansas City.

In recent years, Mr. Gillham made his home in Santa Barbara, Calif. Previous to his retirement four years ago, he had been a lifelong resident of Jackson County. He returned to Kansas City after he became ill.

Mr. Gillham was one of the organizers of the Country Club Masonic Lodge and a member of the Ararat Shrine.

He is survived by his sister, Mrs. Thornton Porter, DeWitt, Mo., and several nieces and nephews. Mrs. Gillham died fourteen years ago.

WILLARD F. UHL
Minneapolis, Minn.

Willard F. Uhl, president, Uhl Co., Inc., died suddenly of heart failure on August 29, 1955. Mr. Uhl, who had been active in gaining new Society members, served the Minnesota Chapter as president in 1932, having served previously as vice president and secretary. He was also a member of

Willard F. Uhl

the board of governors of that chapter in 1929 and 1933. A member of the Society since 1918, he was honored by Life Membership six years ago.

Born in Maxwell, Ia., on April 26, 1884, Mr. Uhl was graduated from Iowa State College with a degree in electrical engineering in 1907. He served his apprenticeship with Westinghouse Electric and Manufacturing Co., Pittsburgh; Canadian Westinghouse Co., Northern Electric Co., and Imperial Wire and Cable Co., Winnipeg, Manitoba.

Leaving Canada in 1915, he joined C. A. Dunham Co. in Marshalltown, Ia., assuming management of their Minneapolis, Minn., branch the following year. Around this time he became co-founder of Uhl Co., which operated as a partnership until its recent incorporation.

AMERICAN SOCIETY OF

OFFICERS and COUNCIL

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Three Years: B. W. Farnes, C. B. Gamble, W. A. Grant, D. M. Mills.

Two Years: J. H. Fox, A. J. Hess, C. H. Pesterfield, B. H. Spurlock, Jr.

One Year: I. W. Cotton, A. W. Edwards, L. N. Hunter, R. T. Kern, L. T. Mart.

STAFF

Headquarters: 62 Worth St., New York 13, N.Y.
Technical Secretary.....Carl H. Flink
Assistant Secretary.....David T. Donovan
Editor.....C. H. B. Hotchkiss
Public Relations.....W. M. Vidulich

Research Laboratory: 7218 Euclid Ave., Cleveland 3, Ohio
Director of Research.....E. R. Kaiser
Assistant Director.....C. M. Humphreys

ADVISORY BOARD

L. N. Hunter, Chairman; Lester T. Avery, M. F. Blankin, S. E. Dibble, S. H. Downs, E. O. Eastwood, W. L. Fleisher, H. P. Gant, H. M. Hart, C. V. Haynes, D. D. Kimball, S. R. Lewis, A. J. Offner, F. B. Rowley, L. E. Seeley, A. E. Stacey, Jr. Ernest Szekely, Reg. F. Taylor, G. L. Tuve, A. C. Willard, C.-E. A. Winslow and B. M. Woods.

COUNCIL COMMITTEES

Executive: John W. James, Chairman; P. B. Gordon, E. R. Queer.

Finance: E. R. Queer, Chairman; W. A. Grant, A. J. Hess, B. H. Spurlock, Jr.

Ways and Means: J. C. Fitts, Chairman; I. W. Cotton, John Everetts, Jr., C. A. McKeeman, E. R. Queer.

Membership: B. W. Farnes, Chairman; C. B. Gamble, L. T. Mart.

Program and Papers: A. J. Hess, Chairman; W. A. Grant, C. H. Pesterfield.

GENERAL COMMITTEES

Admission and Advancement: Roswell Farnham, Chairman (one year); C. S. Koehler (two years); F. H. Buzzard (three years).

Publication: Axel Marin, Chairman (one year); G. B. Priester (two years); W. J. Collins, Jr. (three years).

Guide: W. M. Wallace, II, Chairman; P. R. Achenbach, A. A. Marks (one year); Albert Giannini, A. T. Jones, J. F. Sandfort (two years); R. A. Gonzalez, N. B. Hutcheon, M. W. Keyes (three years); B. H. Jennings, Ex Officio.

Charter and By-Laws: M. W. Bishop, Chairman (one year); A. E. Stacey, Jr. (two years); J. D. Kroeker (three years).

F. Paul Anderson: John W. James, Chairman; Lester T. Avery, P. D. Gayman, E. P. Heckel, Reg. F. Taylor.

Chapter Relations: P. B. Gordon, Chairman; I. W. Cotton, A. W. Edwards, J. H. Fox, A. J. Hess, D. M. Mills, B. H. Spurlock, Jr.

Chapters Conference: J. S. Burke, Chairman; J. E. Schechter, Vice Chairman; R. S. Stover, Secretary. Members and Alternate Members selected by local chapters are respectively:

ARIZONA: V. J. Carns—E. P. Maxwell
ARKANSAS: J. W. Thompson—W. A. Bullard
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(61 Chapters: 1 Special Branch; 6 Student Branches)

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Arizona: 1953. Hdqrs., Phoenix. Meets, 1st Mon. PRES, W. A. Biddle, 3817 N. 15th Ave. SECY, E. P. Maxwell, 39 W. Adams St.

ARKANSAS

Arkansas: 1952. Hdqrs., Little Rock. Meets, 3rd Tues. PRES, W. J. Franklin, 608 W. Third St. SECY, J. W. Thompson, 1314 Main St.

CALIFORNIA

Golden Gate: 1937. Hdqrs., San Francisco. Meets, 1st Thurs. PRES, D. E. McLeod, 2415 Green St. (23). SECY, Herb Duncan, 938 N. Linden Ave., South San Francisco.

Sacramento Valley: 1952. Hdqrs., Sacramento. Meets, 1st Wed. PRES, R. A. Sarro, 5412 Argo Way (21). SECY, M. J. Delavan, 405 Meister Way (19).

Southern California: 1930. Hdqrs., Los Angeles. Meets, 1st Tues. PRES, J. L. McCullough, 1978 S. Los Angeles St. (11). SECY, W. J. Biggar, 6620 Telegraph Rd. (22).

COLORADO

Rocky Mountain: 1944. Hdqrs., Denver. Meets, 1st Wed. PRES, L. L. DeLong, 2027 S. Washington St. (10). SECY, W. V. Burbank, P.O. Box 840.

CONNECTICUT

Connecticut: 1940. Hdqrs., New Haven. Meets, 3rd Thurs. PRES, E. J. Hoagland, 257 Whitney St., Hartford. SECY, J. D. Pierce, 775 Capitol Ave., Hartford.

DISTRICT OF COLUMBIA

Washington: 1935. Hdqrs., Washington. Meets, 2nd Wed. PRES, W. C. Reamy, Jr., 720 Mills Bldg. (6). SECY, S. H. Robbins, Jr., 2117 M Street, N.W. (7).

GEORGIA

Atlanta: 1937. Hdqrs., Atlanta. Meets, 2nd Mon. PRES, T. A. Barrow, Jr., 302 Ponce de Leon Ave., N.E. (8). SECY, J. A. Marshall, 1415 Howell Mill Rd., N.W.

ILLINOIS

Illinois: 1906. Hdqrs., Chicago. Meets, 2nd Mon. PRES, G. G. Freyder, 72 W. Adams St. (90). SECY, Herbert Kreisman, 117 N. Desplaines St. (6).

INDIANA

Indiana: 1943. Hdqrs., Indianapolis. Meets, 4th Tues. PRES, J. W. Jackson, 1531 N. Pennsylvania St. (2). SECY, G. W. Vogel, 31 E. Georgia St. (4).

IOWA

Iowa: 1940. Hdqrs., Des Moines. Meets, 2nd Tues. PRES, G. J. Kraai, 907 Sixth Ave. (14). SECY, W. A. Schworm, Physical Plant Dept., Iowa State College, Ames.

KANSAS

Kansas: 1951. Hdqrs., Wichita. Meets, Tues. after 1st Mon. PRES, A. B. Newton, 3511 Elmwood Dr. (17). SECY, T. L. Roberts, 2008 S. Parkwood Lane (18).

KENTUCKY

Bluegrass: 1954. Hdqrs., Louisville. Meets, 2nd Mon. PRES, W. M. Pace, 218 Don Allen Rd. (7). SECY, R. B. Duggan, 41 Beechwood Rd., Jeffersonville, Ind.

LOUISIANA

Baton Rouge: 1955. Hdqrs., Baton Rouge. Meets, 3rd Wed. PRES, C. S. Woodruff, P.O. Box 358. SECY, A. J. Mayers, Jr., 7732 Goodwood Ave.

Delta: 1939. Hdqrs., New Orleans. Meets, 3rd Tues. PRES, W. B. Martin, Jr., 635 Commercial Pl. (12). SECY, R. K. Goode, 3613 Pine St. (25).

Shreveport: 1948. Hdqrs., Shreveport. Meets, 3rd Thurs. PRES, R. S. Segall, 848 River Rd. SECY, A. L. Jones, Jr., 753 Gladstone.

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Baltimore: 1949. Hdqrs., Baltimore. Meets, 3rd Wed. PRES, E. I. Morris, 813 N. Calvert St. (2). SECY, E. J. Dull, 1122 N. Charles St. (1).

MASSACHUSETTS

Massachusetts: 1912. Hdqrs., Boston. Meets, 3rd Tues. PRES, G. D. Fife, 79 Milk St. SECY, R. F. Curry, 80 Ripley St., Newton Centre (59).

Western Massachusetts: 1955. Hdqrs., Springfield. PRES, R. E. Cross, 114 Boston Rd. SECY, F. A. Ferraro, 172 Chestnut St.

MICHIGAN

Michigan: 1916. Hdqrs., Detroit. Meets, 1st Mon. after 10th of month. PRES, D. S. Falk, 4864 Woodward Ave. (1). SECY, J. H. Spitzley, 1200 W. Fort St. (26).

Western Michigan: 1931. Hdqrs., Grand Rapids. Meets, 2nd Mon. PRES, S. M. Paganelli, 47 N. Division Ave. SECY, B. J. Walter, 333 Fuller Ave., N.E.

MINNESOTA

Minnesota: 1918. Hdqrs., Minneapolis. Meets, 1st Mon. PRES, J. S. Locke, 2753 Fourth Ave., S. (8). SECY, F. G. Vogt, 6530 W. Lake St. (16).

MISSISSIPPI

Mississippi: 1953. Hdqrs., Jackson. Meets, 4th Mon. PRES, J. E. Davis, Jr., P.O. Box 3216, West Jackson (7). SECY, L. H. Smith, 711 W. Capitol St.

MISSOURI

Kansas City: 1917. Hdqrs., Kansas City. Meets, 1st Mon. PRES, A. S. Hurt, Jr., 2119 Washington St. (8). SECY, S. C. McCann, 210 W. Tenth St. (5).

St. Louis: 1918. Hdqrs., St. Louis. Meets, 2nd Tues. PRES, E. T. Clucas, 4354 Olive St. SECY, N. J. Hubbuch, Jr., 7020 Cornell, University City (5).

NEBRASKA

Nebraska: 1940. Hdqrs., Omaha. Meets, 2nd Tues. PRES, T. E. Davis, 4303 Dodge St. SECY, C. A. Failer, 1802 Mason St. (2).

NEW JERSEY

North Jersey: 1952. Hdqrs., Newark. Meets, 2nd Tues. PRES, C. H. Smith, 2300 N. Stiles St., Linden. SECY, M. C. Christesen, 196 Everett Pl., Englewood.

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New Mexico: 1954. Hdqrs., Albuquerque. Meets, 3rd Mon. PRES, H. F. Munn, 419 Granite, N.W. SECY, J. K. James, 4462 Avenida del Sol.

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Central New York: 1944. Hdqrs., Syracuse. Meets, 4th Wed PRES, F. D. Putnam, 115 Pulsifer Dr., Auburn. SECY, Merle Weninger, 230 Goodrich Ave. (5).

Empire State Capital: 1951. Hdqrs., Albany. Meets, 2nd Wed. PRES, L. V. Appleby, N. Pearl & Van Woert Sts. (4). SECY, E. J. Mahoney, 45 Colvin Ave.

New York: 1911. Hdqrs., New York. Meets, 3rd Mon. PRES, Albert Giannini, 385 Madison Ave. (17). SECY, Carl H. Flink, 62 Worth St. (13).

Western New York: 1919. Hdqrs., Buffalo. Meets 2nd Mon. PRES, C. W. Kaupp, 271 Delaware Ave. (2). SECY, J. P. Guerra, 34 E. Depew Ave. (14).

NORTH CAROLINA

Northern Piedmont: 1952. Hdqrs., Greensboro. Meets, 2nd or 3rd Fri. PRES, S. T. Oliver, 2307 Fairfield Ave. SECY, E. D. Frazier, 320 Ashland Dr.

Southern Piedmont: 1952. Hdqrs., Charlotte. PRES, L. F. Lawrence, Jr., 212 Greystone Rd. SECY, G. C. Garrett, P.O. Box 3697.

OHIO

Central Ohio: 1944. Hdqrs., Columbus. Meets, 3rd Mon., PRES, R. A. Wilson, 2240 N. High St. SECY, T. R. Walker, 182 N. Yale Ave.

Cincinnati: 1932. Hdqrs., Cincinnati. Meets, 1st Tues. PRES, A. H. Gerdsen, 224 E. Second St. (2). SECY, T. D. Reiley, 1905 Dunlap St. (14.)

Miami Valley: 1950. Hdqrs., Dayton. Meets, 1st Wed. PRES, D. E. Tullis, 1720 Parkhill Drive (6). SECY, L. P. Brehm, Jr., 111 S. Broomfield Rd.

Northern Ohio: 1916. Hdqrs., Cleveland. Meets, 2nd Mon. PRES, L. C. Burkes, 1792 E. 40th St. SECY, R. A. Urban, Sr., 1740 E. 12th St. (14).

Toledo: 1954. Hdqrs., Toledo. PRES, C. F. Hoffman, 523 Spitzer Bldg. (4). SECY, R. I. Fruth, 1316 Adams St. (2).

OKLAHOMA

Oklahoma: 1935. Hdqrs., Oklahoma City. Meets, 2nd Mon. PRES, J. R. Patten, 1726 N.W. Fifth (6). SECY, A. C. Shelley, 2946 Nimitz (12).

Northeastern Oklahoma: 1948. Hdqrs., Tulsa. Meets, 2nd Tues. PRES, J. T. McKinney, P.O. Box 5145 (16). SECY, G. A. McCune, 1908 Utica Square.

OREGON

Oregon: 1939. Hdqrs., Portland. Meets, Thurs. after 1st Tues. PRES, Dick Blankenship, Cascade Bldg. (4). SECY, W. B. Hayes, 707 Portland Trust Bldg. (4).

PENNSYLVANIA

Philadelphia: 1916. Hdqrs., Philadelphia. Meets, 2nd Thurs. PRES, A. M. Robertson, 1200 Locust St. (7). SECY, R. J. Sigel, 822 Montgomery Ave., Narberth.

Pittsburgh: 1919. Hdqrs., Pittsburgh. Meets, 3rd Mon. PRES, C. L. Benn, 420 Blvd. of Allies (19). SECY, E. H. Riesmeyer, Jr., 231-33 Fort Pitt Blvd. (22).

SOUTH CAROLINA

South Carolina: 1954. Hdqrs., Columbia. PRES, R. K. Rouse, P.O. Box 3731, Greenville. SECY, B. A. Leppard, P.O. Box 3294, Station "A," Greenville.

TENNESSEE

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TEXAS

North Texas: 1938. Hdqrs., Dallas. Meets, 3rd Mon. PRES, J. A. Ray, 4411 Belmont Ave. (4). SECY, G. H. Meffert, 3328 Greenbrier Dr. (5).

South Texas: 1938. Hdqrs., Houston. Meets, 3rd Fri. PRES, F. M. Neil, P.O. Box 13197 (19). SECY, A. B. Ullrich, 2520 Huldy St. (19).

Southwest Texas: 1946. Hdqrs., San Antonio. Meets 3rd Tues. PRES, F. B. Frazee, 1013 Riverside Dr., Austin (4). SECY, J. L. Rea, Jr., 300 West 8th St., Austin.

West Texas: 1953. Hdqrs., Lubbock. Meets, 1st Tues. PRES, R. S. Carow, P.O. Box 3206. SECY, H. L. Mayes, P.O. Box 151.

UTAH

Utah: 1944. Hdqrs., Salt Lake City. Meets, 3rd Thurs. PRES, R. C. Evans, 2549 Wilmington Ave. (6). SECY, G. E. Wright, Jr., Dooly Bldg.

VIRGINIA

Virginia: 1946. Hdqrs., Norfolk. Meets, 3rd Wed. PRES, T. B. Carpenter, 8400 Millard St. SECY, C. G. Conaway, Jr., 4701 Colley Ave. (5).

WASHINGTON

Inland Empire: 1950. Hdqrs., Spokane. Meets, 1st Mon. PRES, F. W. Jenkinson, 228 Hutton Bldg. SECY, J. A. Doyle, W. 3018 Broad.

Pacific Northwest: 1928. Hdqrs., Seattle. Meets, 2nd Tues. PRES, P. I. L. Winsor, 20031 Marine View Dr., S.W. (66). SECY, M. W. McKinstry, 4017 McGilvra St. (2).

WISCONSIN

Wisconsin: 1922. Hdqrs., Milwaukee. Meets, 3rd Mon. PRES, I. J. Rossiter, 231 W. Wisconsin Ave. (3). SECY, R. D. Rodwell, 152 W. Wisconsin Ave. (3).

CANADA

British Columbia: 1952. Hdqrs., Vancouver. Meets, 2nd Wed. PRES, Cornelius Van Boeyen, 636 Drake St. (3). SECY, A. C. Martin, 425 W. Second Ave.

Manitoba: 1935. Hdqrs., Winnipeg. Meets, 4th Thurs. PRES, G. C. Davis, 212 Waverly St. (9). SECY, A. H. Millar, 342 Mandeville St., St. James (12).

Montreal: 1936. Hdqrs., Montreal. Meets, 3rd Mon. PRES, R. J. Ker, 5000 Namur St. (9). SECY, W. E. Jarvis, P.O. Box 61.

Ontario: 1922. Hdqrs., Toronto. Meets, 1st Mon. PRES, M. C. Bailey, 1139 Bay St. SECY, H. R. Roth, 57 Bloor St., W.

Ottawa Valley: 1952. Hdqrs., Ottawa. Meets, 3rd Tues. PRES, E. J. Schoenherr, 32 Clarey Ave. (1). SECY, D. W. Banton, 360 Richmond Rd. (3).

SPECIAL BRANCH

Switzerland: 1952. Hdqrs., Zurich. PRES, H. C. Bechtler, Anemonenstrasse 40 (47). SECY, Walter Hausler, Erbstrasse 2, Kusnacht.

STUDENT BRANCHES

North Carolina State College: 1948. Hdqrs., Raleigh. PRES, R. E. Crawford, 106½ Logan Ct. SECY, S. R. Moore, Box 4317, State College.

Oregon State College: 1949. Hdqrs., Corvallis. Meets, 1st Wed. after 1st Tues. PRES, P. I. Anderson, 202 N. 10th. SECY, D. W. Strahan, 233 Mall St.

Purdue University: 1948. Hdqrs., W. Lafayette, Ind. PRES, D. B. Doucette, Purdue Student Branch, ASHAE School of Mech. Engrg. SECY, J. W. Deabler, Purdue Student Branch, ASHAE, School of Mech. Engrg.

Texas A. & M. College: 1946. Hdqrs., College Station. Meets, 2nd and 4th Tues. PRES, D. F. Carroll, Box 6264. SECY, C. W. Farrar, Jr., Rt. 1, Box 339, Bryan.

University of Detroit: 1949. Hdqrs., Detroit. Meets, 1st Tues. PRES, J. C. Rumpf, 16511 Muirland (21). SECY, L. J. Hayes, Jr., University of Detroit.

University of Toronto: 1951. Hdqrs., Toronto. PRES, W. A. Stewart, 86 Roxborough St., W. (5). SECY, R. M. Davies, 144 Manor Rd., E.

CASING ENHANCES LOW APPEARANCE OF LOWEST SILHOUETTE COOLING TOWER

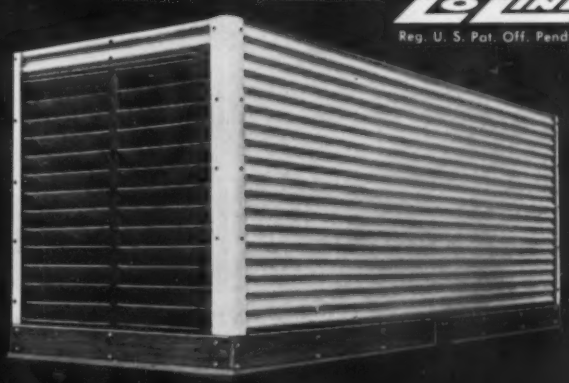
The Pritchard *LOLINE* Cooling Tower is the lowest tower of 75 tons capacity and up now available. And the casing on this new tower has been carefully designed to enhance this low appearance. Corrugated asbestos cement board panels are *horizontally* installed to give low, architecturally perfect lines to the tower. Even the corners are of asbestos board and are designed to add to the attractive appearance.

FEATURES UNIQUE IN SILHOUETTE TOWER CONSTRUCTION

- New Pritchard framework design.
- Special water piping arrangement.
- New ease in installation and maintenance.
- Lower pumping head and power usage.
- New design, nail-less filling.
- Individually removable asbestos louvers.
- Trouble-free mechanical equipment.

GET THE WHOLE PICTURE!

Send for your complimentary copy of the new Pritchard *LO LINE* Cooling Tower bulletin. It describes each construction feature in detail, with accompanying illustrations, capacities and specifications, cross-sectional drawing. Send for it today.



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GAS & AIR TREATING EQUIPMENT

REPRESENTATIVES IN PRINCIPAL CITIES FROM COAST TO COAST

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OF CALIFORNIA
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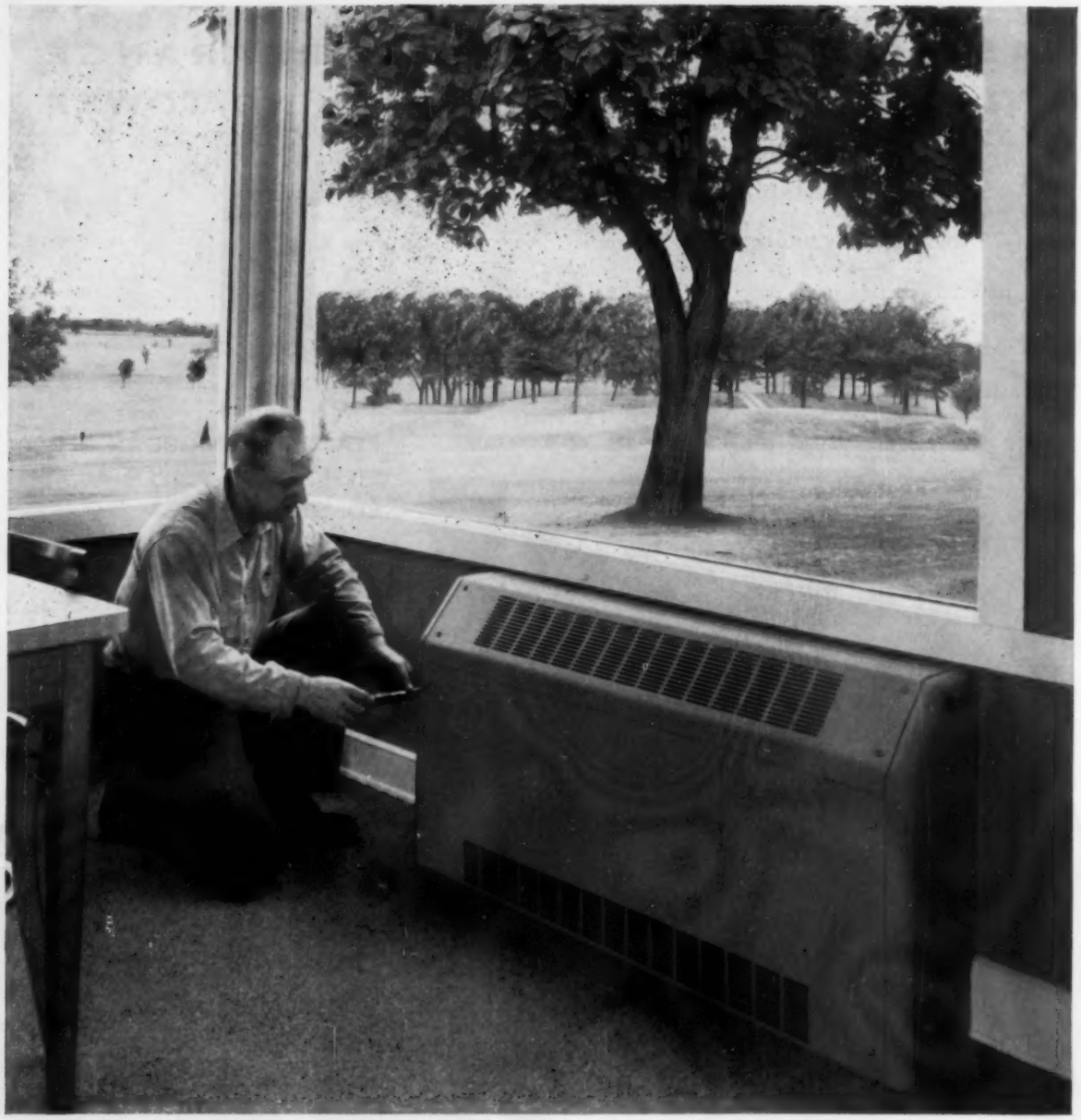
Dept. 462, 4625 Roanoke Parkway, Kansas City 12, Mo.



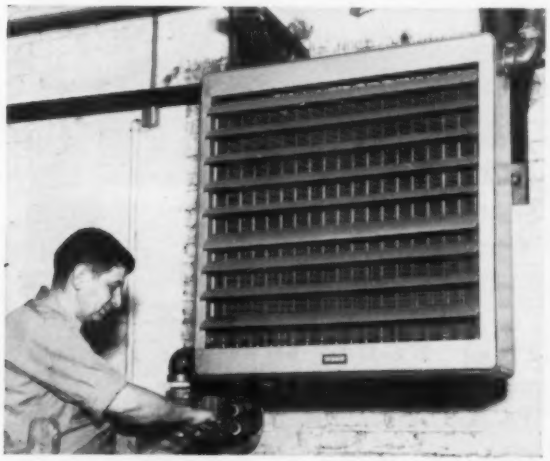
Dunham Heating-Cooling Units filter, heat, cool, ventilate and dehumidify air on individual room basis. No central system duct-work needed.

Your best move when you want to move air

...depend on Dunham Unit Heaters

Dunham Cabinet Unit Heaters . . . in capacities from 18,000 to 108,000 Btu. 7 different styles. Double end shaft motor with twin blower fans mounted on motor shaft.

Dunham Vertical Discharge Unit Heaters . . . in capacities from 30,240 to 576,000 Btu. Two models available. Four types of air diffusers.



Dunham Horizontal Discharge Unit Heaters . . . in capacities from 15,600 to 360,000 Btu. Two models available. Single two-speed, and multispeed motors.

Dunham Blower Unit Heaters . . . 17 different sizes in 170 ratings from 125,000 to 1,500,000 Btu.—1,430 to 20,800 c.f.m. Five types of mountings.

Depend on Dunham for unit heaters and you help yourself several money-saving ways. First of all, you get what you want . . . when you want it . . . from one source.

No matter which type of heater you need—Horizontal Discharge, Vertical Discharge, Blower, Cabinet or Heating-Cooling Units—you can find a model in the capacity range your job calls for. Dunham's line of steam and hot water unit heaters is complete, as shown above . . . looks good anywhere.

And all Dunham Unit Heaters have design features that simplify installation . . . construction features that make for minimum maintenance. Depend on Dunham to supply *all* your heating needs so that responsibility for your finished job rests on one manufacturer! For more detailed information, write for Bulletin HPAC-11. C. A. Dunham Company, 400 W. Madison Street, Chicago 6, Illinois.

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C. A. DUNHAM COMPANY • CHICAGO • TORONTO • LONDON

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COPPER

WHERE IT COUNTS

U. S. VETERAN'S HOSPITAL

Lisbon (Dallas) Texas

Architect: VETERANS' ADMINISTRATION, Washington, D. C.
Gen. Cont.: J. W. BATESON CO., INC., Dallas, Texas
Mech. Cont.: FARWELL COMPANY, INC., Dallas, Texas
Revere Dist.: SOUTHLAND SUPPLY CO., Dallas, Texas

. . . USES 65,543 FEET OF REVERE COPPER WATER TUBE

for water and oxygen lines

In the hospitals being erected today oxygen lines are being built-in, the same as hot and cold water lines. And the predominant material being used for these oxygen lines is copper.

There are some very good reasons for this. First, the enduring qualities of copper have been proved for centuries. Second, copper does not rust. Third, copper tube is safe because the joints used are brazed, prevent dangerous leaks. Fourth, the interior gun-barrel smoothness assures free flow of oxygen and various other gases and fluids. This same smoothness also makes it possible for oxygen lines to be kept spotlessly clean at all times.

Revere Copper Water Tube is not only safe, and long-lasting, it's economical. Contractors tell us that the more they use it the more they see the many economies that can be realized. "All things considered," they say, "copper water tube costs less to install than rustable pipe."

Keep out of trouble with copper. Use Revere Copper Tube for oxygen lines, air conditioning lines, radiant panel heating, hot and cold water lines, underground service lines, waste lines and vent stacks, processing lines.

And if you have any installation problems involving Revere Copper Water Tube, write us and we'll see to it that Revere's Technical Advisory Service gives you a helping hand.

FREE! *For group showing. Instructive 16 mm motion pictures in sound and full color. "THE ABC OF RADIANT PANEL HEATING" and "THE RURAL WATER SYSTEM." Write Advertising Dept., for details.*

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COPPER AND BRASS INCORPORATED

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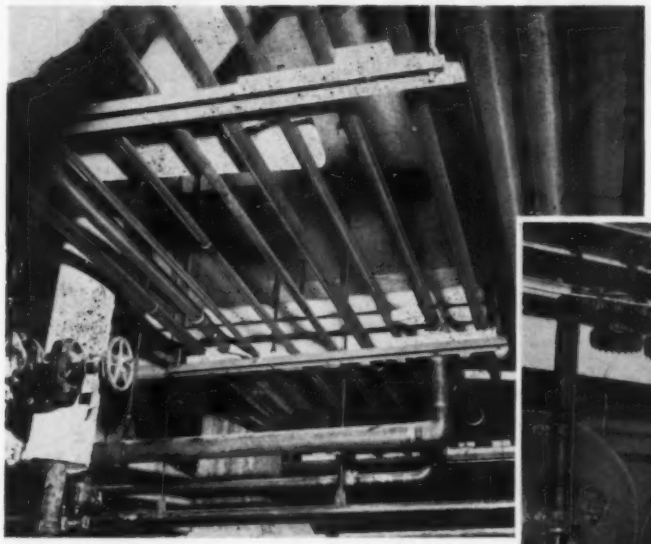
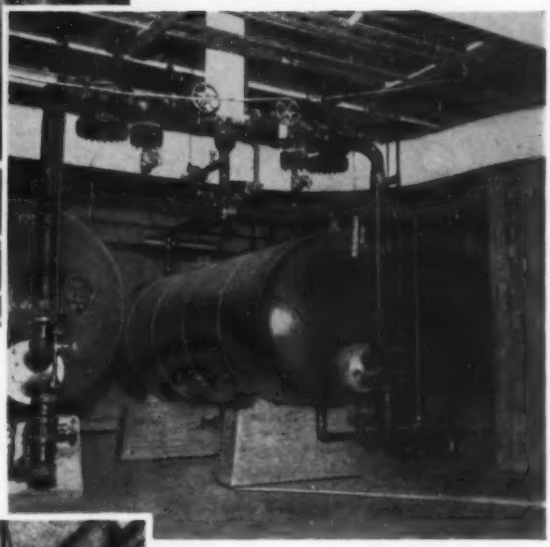
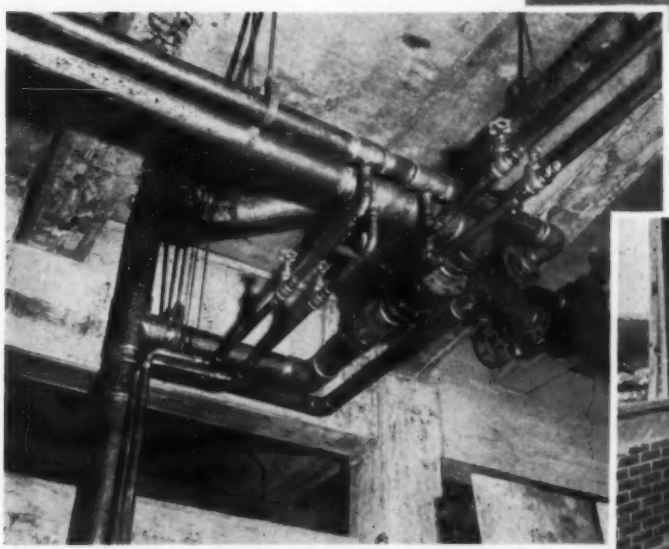
Sales Offices in Principal Cities, Distributors Everywhere.



MAIN PIPE RUNWAY showing the hot and cold water, air and oxygen lines of Revere Copper Water Tube.



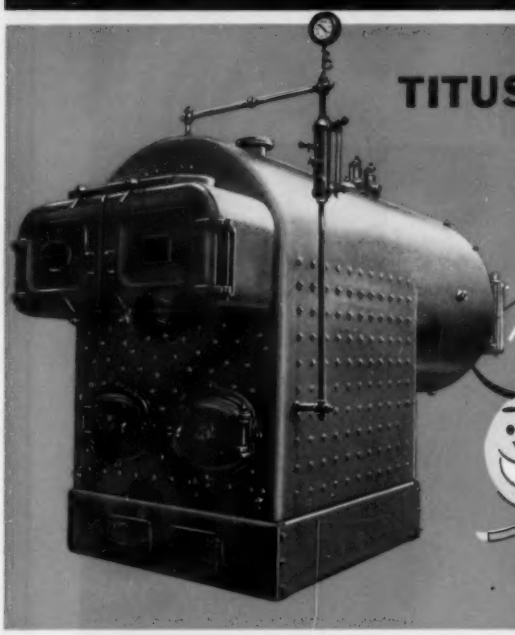
TO ASSURE CLEAN, FULL-FLOWING WATER at all times the hospital is also equipped with 5 water storage tanks of Revere Herculoy, a silicon bronze alloy that does not rust and has the strength of mild steel. Hot water generators and tanks were fabricated by OLD DOMINION IRON & STEEL COMPANY, Richmond, Va.



INDIVIDUAL ROOM OXYGEN LINES of Revere Copper Tube with brazed joints guard against dangerous leaks.

65,543 FEET OF REVERE COPPER WATER TUBE were used in sizes ranging from ½" to 6" in diameter. Imagine, if you will, making this installation with ferrous pipe that requires threading.

LEADERS IN THEIR FIELD!

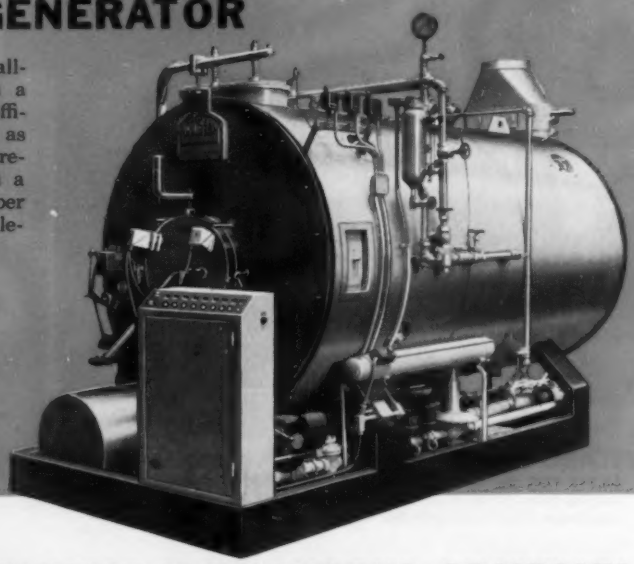


TITUSVILLE TYPE WP FIREBOX BOILER

Precision die formed, fusion-welded into a sturdy one-piece unit, this popular Titusville boiler remains tight and leakproof under all operating conditions. Low fuel consumption, low maintenance and high efficiency make the WP first choice in firebox type high pressure boilers. 12 sizes, 250 to 2500 sq ft heating surface. Bulletin B-3030.

TITUSVILLE Ticosteam PACKAGE STEAM GENERATOR

Completely automatic in operation, the all-welded Titusville Ticosteam Generator is a package boiler with a wealth of features for efficiency and safety. It is ready to go to work as soon as connected to the usual services, requires vent only (no high stack) and has a minimum heating surface of 5 square feet per boiler horsepower. Sizes 20 to 350 H.P. Bulletin B-3100.



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THE TITUSVILLE IRON WORKS COMPANY

TITUSVILLE, PENNSYLVANIA

***Manufacturers of* A Complete Line of Boilers for Every Heating and Power Requirement**

THE ONLY Matched

COOLING TOWERS and CONDENSERS

The Halstead & Mitchell Cooling Towers you select are *matched* by design to work with the famous Halstead & Mitchell water-cooled Condensers. You need no longer buy a high-efficiency cooling tower to work with a low-efficiency condenser (or *vice-versa*) . . . a long-life cooling tower to work with a short-life condenser (or *vice-versa*).

Remember that every cooling tower you sell is planned to work with a water-cooled condenser—then you'll see why America's leading manufacturers of air-conditioning and refrigeration equipment have swung to Halstead & Mitchell for their original equipment needs in both these components.

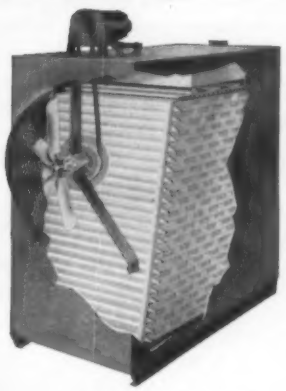
With cleanability you'll sell more. Why sell less?

20-Year Guarantee!

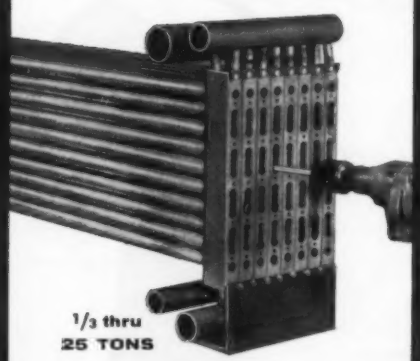
on the wetted deck surface against rotting or fungus attack

Only Halstead & Mitchell pressure-creosoting can provide a *guarantee* against immediate attack by fungus and marine parasites . . . or chemical deterioration from acids in water.

Added to this H&M exclusive are other major advantages. There's ultra-high efficiency in the gravity-type water distributing pan which eliminates extra pumping head required on spray type towers . . . and cuts down on water losses due to "atomizing" of water. And there's extra-long life in stainless steel fans . . . and sheet steel cabinets hydraulically painted with vinsynite, vinyl zinc and chlorinated rubber.



2 thru 120 TONS



1/3 thru 25 TONS

Lifetime Cleanability

The *mechanical* cleaning of H&M double-tube, counter-flow condensers means the simplest, least dangerous method of restoring new unit efficiency. Whether removing a heavy coating of sludge and scale, or a thin insulating film on the inner walls of the copper tubing, the mechanical cleaning tool restores heat transfer efficiency in a matter of minutes. The result is lowered discharge pressures . . . more heat carried off by cooling water . . . lower bills. *Only* the impurities are removed . . . the thickness of the copper wall remains intact, and the condenser gives extra years of peak service.

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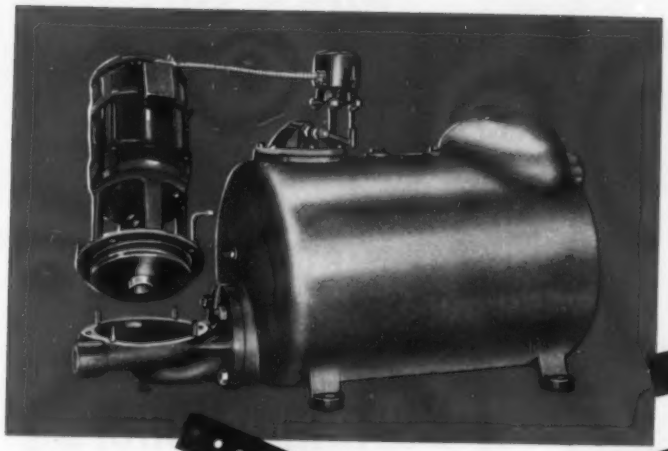
Let's look into a SKIDMORE



TYPE "VC" CONDENSATION PUMP

• • • QUIET OPERATION

• • • LOW INLET CONNECTION

• • • STURDY CAST IRON

• • ACCESSIBILITY WITHOUT DISTURBING PIPING

Contractors, engineers, architects — men who specify heating pumps, look to Skidmore for a dependable source. They know that in every Skidmore Pump is built years of service and dependability . . . they know that from past experience Skidmore has just the type and capacity for their job, regardless of installation requirements.

Add to this, the practically service-free performance — the sturdy balanced construction. Yes, look into a Skidmore Pump, and then you can see why Skidmore has been synonymous with quality pump engineering since 1921.

Type "VC" Condensate Pump (duplex unit shown above) is perfectly balanced to assure quiet, smooth operation. Capacities range from 1,000 to 65,000 sq. ft. E.D.R. Discharge pressures from 10 to 75 lbs.

SKIDMORE PUMPS

Write for Bulletin No. 10-B on Type "VC" Pump

SKIDMORE CORPORATION • ST. JOSEPH, MICHIGAN

BASE-RAY

for

Beauty and *Comfort!*

BASE-RAY* Radiant Baseboard's matchless beauty is a sales argument that speaks volumes to your prospects. Women start mentally picturing the endless furniture arrangements they can have with BASE-RAY the moment they see it. BASE-RAY saves floor space, creates a roomier-than-it-is effect . . . leaves all wall space free. And BASE-RAY can't be topped for comfort—it's truly the best way to enjoy the magic of hot water heating. BASE-RAY is made of rugged cast iron for lifetime performance. Easily installed—no venting problems—no expansion noise and no "pings". And remember Burnham was first in the manufacture of baseboard heating. BASE-RAY is now available in two sizes, No. 7 and No. 9.

BURNHAM BOILERS are quality all the way . . . quality engineering, quality materials and quality performance. Display, feature and "talk up" the famous Burnham line and you'll profit *two* ways . . . first, from the sale at hand and, second, you'll be building the kind of reputation that means *future* business. There's a rugged Burnham Boiler for every need and all of them give your customers plenty of domestic hot water for kitchen, laundry and bath the whole year 'round. Mention that fact—it's a powerful sales factor! Add to this the obvious advantages of hot water heating over other methods and you have plenty of "reasons why" for even the toughest prospect. AND ALL Burnham Boilers are made of cast iron for long life and trouble-free service.

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CLEAN WITH TAP WATER — Evans filters can be cleaned clean in minutes with nothing ever but tap water sprayed through an ordinary garden hose nozzle. They require no expensive fireproof room. No caustic cleaning solutions or agents. This eliminates all danger in the cleaning of Evans filters.

LIGHT WEIGHT CUT LABOR COSTS — Evans filters are all aluminum. Light to handle, to carry, to pick up. In spite of airtight fitting frames, Evans filters pull quickly and easily in and out of the frames. Take much less effort, less labor to handle. No latches . . . or lugs *required.*

REMEMBER: Initial costs for air cleaning equipment are not the big factors or controlling factors in the cost for clean air.

IT'S OPERATING COSTS THAT YOU MUST LIVE WITH AND THAT YOU MUST CONTROL.

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- ALL ALUMINUM
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- HOLD UP TO 200% MORE DUST AND LINT WITHOUT HARMFUL RESTRICTION TO AIRFLOW
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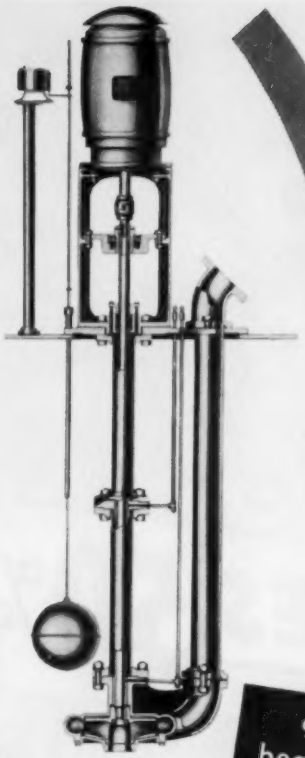

90% fewer bearing failures

use Yeomans Vertical Wet Pit Centrifugal Pumps

These are the pumps you can install and forget. Many have been in service 30 years . . 35, 40, 45, yes 50 years . . way back when Elihu Root was Secretary of State.

Today, Yeomans Vertical Wet Pit Centrifugal Pumps are even more dependable . . because they feature the exclusive Lubri-Vac® lubrication system. Lubri-Vac gives positive lubrication through a constant flow of lubricant to pump bearings every second the pump is in operation. Bearing surfaces are completely flushed . . it's impossible for abrasive material to work up and cause scoring of bearing surfaces.

Field installations and laboratory tests prove that Lubri-Vac reduces bearing failure and service needs by more than 90%!

Yeomans Wet Pit Centrifugal Pumps are available in the series 8000 for pumping liquids containing solids, dirt and trash . . and in the series 3000 for pumping solids-free liquids.

Series 8000 Heavy-Duty Screenless Ejectors for liquids containing solids, dirt, trash; for heavy liquids, storm drainage, industrial uses. Smallest units pass 2½" solids.

Lubri-Vac® System consists of specially designed impeller and lubricating lines to bearing—eliminates scoring of radial bearing. High carbon piston steel shaft; adjustable single row ball thrust bearing; flexible coupling. Automatic control. Capacities, 10 to 10,000 gpm; heads to 200 ft. Ask for catalog.

Series 3000 Bilge or Sump Pump for solids-free liquids from drainage and seepage, sewage effluents and industrial process wastes. LUBRI-VAC® System standard on all units.

A heavy-duty pump supplied as a complete unit including pump casing, impeller, shaft, suspension and discharge pipes, thrust bearing and flexible coupling assembled on a suspension plate with a catch basin or sump cover, with motor and automatic control equipment. Gravity or forced feed automatic or non-automatic lubrication as required. Capacities from 15 to 1200 gpm; heads to 75 ft. Ask for catalog.

Your Yeomans representative is a competent "pump" man . . trained to understand the problem you expect your pump to solve. He's listed in your Classified Directory under "pumps" . . call him!

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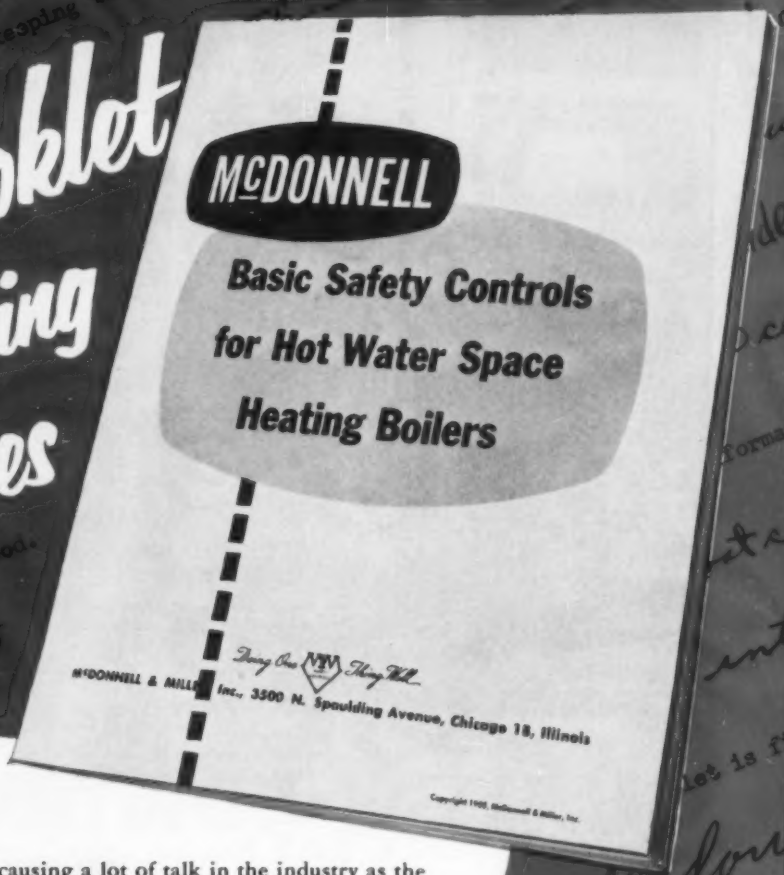
McDONNELL
Basic Safety Controls for Hot Water Space Heating Boilers
Doing One Thing Well
McDONNELL & MILLER Inc., 3500 N. Spaulding Avenue, Chicago 18, Illinois

THIS ILLUSTRATED BOOKLET is causing a lot of talk in the industry as the first authoritative discussion of a most important subject. Essentially it is an engineering booklet rather than a product catalog. In simple, easy-to-follow style it tells why safety devices are needed on hot water space heating boilers, which ones to use, and how to select them. Information every heating man should have.

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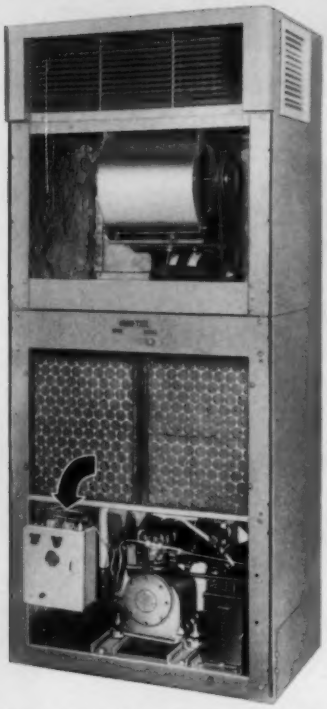
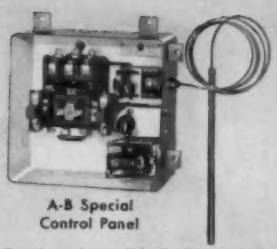
McDONNELL

Boiler Water Level Controls



Interior view of the Melco packaged air conditioner showing Allen-Bradley control.



A-B Special Control Panel

Allen-Bradley air-conditioning controls cover a line of temperature and pressure switches for all operating requirements.

Bulletin 837 temperature control

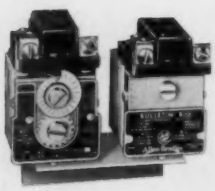
Bulletin 849 automatic timer. Adjustable ¼ sec. to 3 min.

Bulletin 836 pressure switch—available in various forms

Exterior view of the Melco air conditioner made by Melchior, Armstrong, Dessau Co.

QUALITY CONTROLS

for Air Conditioning and Refrigeration



Bulletin 836 high and low pressure cutout. Range—30 in. vacuum to 700 psi.

Bulletin 709 Form 3 solenoid starter with HAND-OFF-AUTOMATIC selector.

Allen-Bradley automatic controls are so popular for air-conditioning and refrigeration service because—

1—Allen-Bradley solenoid starters have only ONE MOVING PART—there are no pins, pivots, levers, or bearings to corrode and stick. Hence, these starters are trouble free.

2—The double break, silver alloy contacts need no maintenance attention. This time and money-saving feature is a "plus value." Just install them . . . and forget them.

3—The thermal overload relays remain accurate and dependable, even after years of service.

Standardize on Allen-Bradley controls . . . you and your servicemen will be money ahead.

Allen-Bradley Co., 1335 S. First St., Milwaukee 4, Wis.
In Canada—Allen-Bradley Canada Ltd., Galt, Ont.

A-B Quality

ALLEN-BRADLEY
SOLENOID MOTOR CONTROL
QUALITY

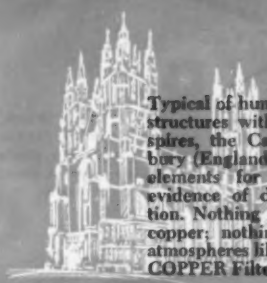
stop wasting money on 'throw-aways' with new

A-LUM-O-AIRE Copper FILTERS

designed for industrial air-cleaning requirements

All standard ½", 1" and 2" sizes or built to your specifications.

Enlarged section showing mat, retainer and frame construction. Frames are aluminized steel for extra strength and light weight.



Typical of hundreds of Old World structures with copper roofs and spires, the Cathedral of Canterbury (England) has withstood the elements for centuries without evidence of decay or deterioration. Nothing resists weather like copper; nothing resists corrosive atmospheres like A-LUM-O-AIRE COPPER Filters!

RESISTS RUST and CORROSION

Impervious to hazardous industrial atmospheres, new A-LUM-O-AIRE COPPER Filters are the practical solution for handling corrosion and moisture-laden fumes, vapors and gases. Copper wool, used as the filter media, is manufactured by Carey to precision standards from special alloys developed expressly for air cleaning. Mat retainers are copper plated for longer life with added protection against rusting and corrosion.

QUICKLY CLEANED for CONTINUOUS USE

Simply flush A-LUM-O-AIRE COPPER Filters with water or solvent and replace. No hazardous oils to add; no messy adhesives required. END pyramiding filter replacement costs NOW with the filter designed for the rugged demands of industry. Available in standard and high-velocity types for normal resistance or engineered to your specific size and capacity requirements.

Carey ELECTRONIC ENGINEERING CO.
METAL WOOL DIVISION
SPRINGFIELD, OHIO

"world's largest manufacturers aluminum and copper wool"

If filtered air is important to your production or operating schedules, here NEWS you can't afford to pass up! Why? Because A-LUM-O-AIRE COPPER Filters save on replacements, eliminate maintenance expense and increase air cleaning efficiency!

Like to see the proof? Then, write for folder showing typical performance curves and operating data — or send us your specifications with prints or detailed drawings for prompt recommendations and quotations. No charge or obligation, of course!

America's *first* practical recleanable all-metal, dry-type air filter! Approved by Underwriters (Class 1)!

A-LUM-O-AIRE

MAIL THIS COUPON TODAY

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Metal Wool Division
1880 Clifton Avenue
Springfield, Ohio

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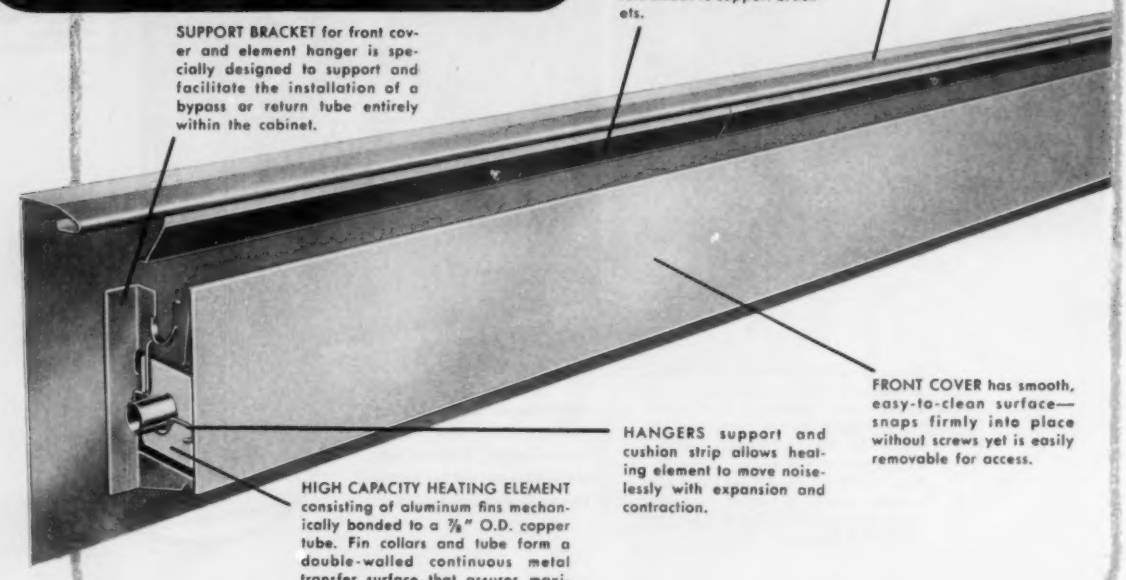
Tell me more—
about your new A-LUM-O-AIRE Filters and show me how we can save money on our air-cleaning activities.

Name_____ Title_____
Company_____
Address_____
City_____ Zone____ State_____

"Perimaheat"
Baseboard Convectors



DAMPER or SPLITTER (optional) can be installed at any time—now or later. Dampers are held in place by retainers snapped into top groove and can be set in any position from fully open to fully closed. Splitters attach to support brackets.

ONE-PIECE BACK AND TOP facilitates easy installation—eliminates air leakage and streaking. Cabinet is suitable for surface mounting or partially recessed installation.

SUPPORT BRACKET for front cover and element hanger is specially designed to support and facilitate the installation of a bypass or return tube entirely within the cabinet.

FRONT COVER has smooth, easy-to-clean surface—snaps firmly into place without screws yet is easily removable for access.

HANGERS support and cushion strip allows heating element to move noiselessly with expansion and contraction.

HIGH CAPACITY HEATING ELEMENT consisting of aluminum fins mechanically bonded to a ⅞" O.D. copper tube. Fin collars and tube form a double-walled continuous metal transfer surface that assures maximum heating efficiency.

CONVECTOR RADIATORS

YOUNG FREE-STANDING CONVECTOR for new or remodeling jobs. Can also be installed semi-recessed.

YOUNG FULLY-RECESSED CONVECTOR unit provides maximum floor space. Front panel projects but ½ inch from wall.

YOUNG WALL-HUNG CONVECTOR sloping top designed for institutions where frequent floor cleaning makes wall hung units desirable.

YOUNG LOW-LEVEL CONVECTOR just 12" high for placing beneath picture windows. Free-standing or semi-recessed.

"Perimaheat" is a Young Radiator Company Trademark

...quick warm-up, high capacity sleek, easy-to-clean cabinets

Lightweight, non-ferrous *Perimaheat* element responds quickly to thermostatic control. There's no lag in heating-up, no overrun. Maximum output is obtained with a minimum of length. Streamlined *Perimaheat* enclosure is designed to be inconspicuous, and is finished in neutral gray for easy painting to match any decorative theme. For further *Perimaheat* details, see the yellow pages of your telephone directory for nearest Young Representative or write, YOUNG RADIATOR COMPANY, Dept. L-515, Racine, Wisconsin.

The Young Radiator Company is a member of the Convector Manufacturers Association and subscribes to the engineering standards of that association.

CMA

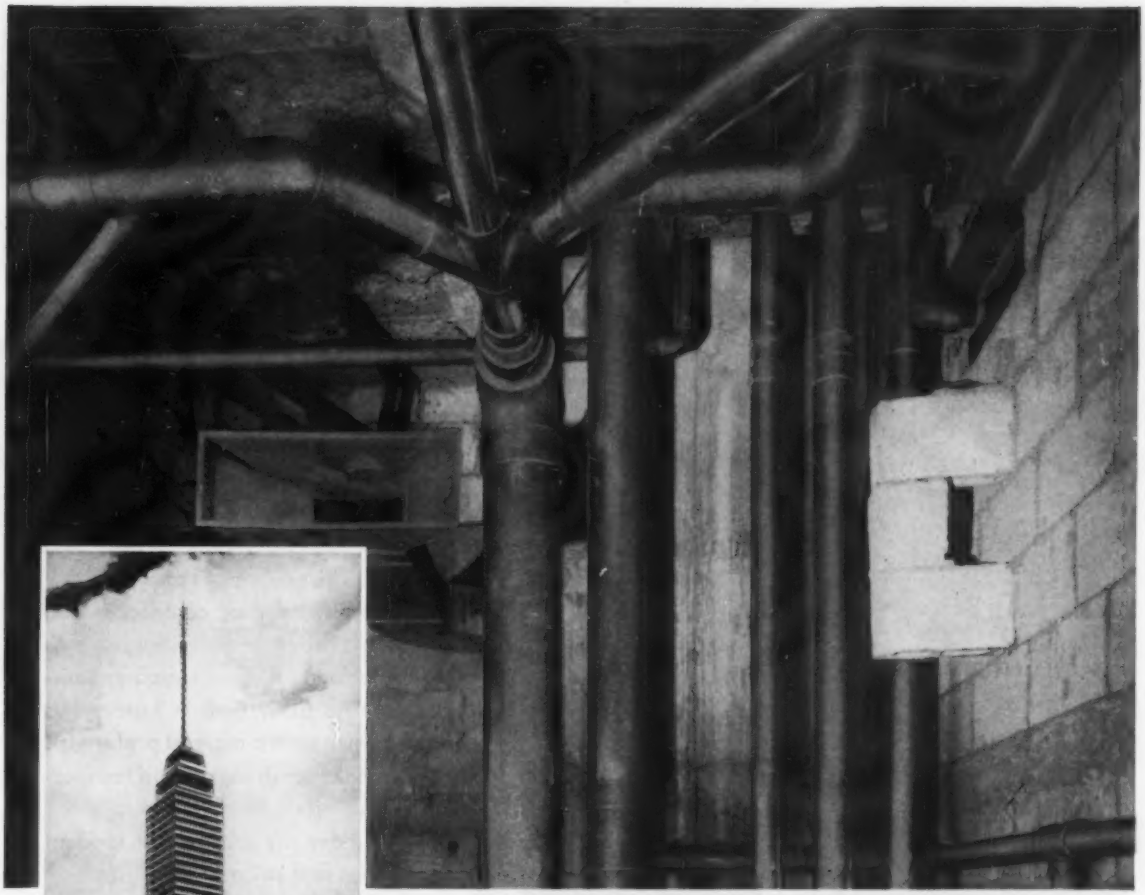
Young RADIATOR COMPANY

RACINE, WISCONSIN

Creative HEAT TRANSFER ENGINEERS FOR INDUSTRY

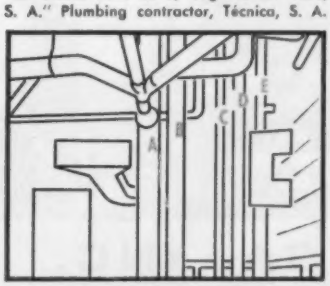
Heat Transfer Products for Automotive, Aviation and Industrial Applications. Heating, Cooling, Air Conditioning Products for Home and Industry.

Executive Office: Racine, Wisconsin, Plants at Racine, Wisconsin, Mattoon, Illinois



Main pipe shaft. Note compact assembly made possible by the trim, space-saving copper tube and fittings. See pipe sizing diagram below, left.

Mexico's newest and tallest skyscraper. General Director: Adolfo Zeevaert, C. E. Constructed by the Engineering Department of "La Latino Americana, Seguros de Vida, S. A." Plumbing contractor, Técnica, S. A.



A 8" soil stack. B 6" vent. C 3" hot water. D 4" cold water. E 3" waste for future use. Laterals to soil stack are 4". All sanitary drainage lines are Type M.

43-Story all-copper plumbing . . . in Mexico's tallest building

COPPER hot and cold water lines
sanitary drainage system
roof drainage lines

100,000 pounds of copper tube, Types K, L and M, provide lasting protection against rust in the plumbing system of this beautiful, ultra-modern office building of the Latino Americana Insurance Company, Mexico City. Tube sizes ranged from ½" to 12" incl. Anaconda tube was used throughout, with Nacional de Cobre of Mexico furnishing the smaller sizes.

For a skyscraper or a small home, copper tube plumbing saves installation time and effort . . . often the over-all cost is less. Its light weight makes it easy to handle. Standard 20' lengths eliminate many joints. Assembly work with solder-type fittings is quickly and easily accomplished.

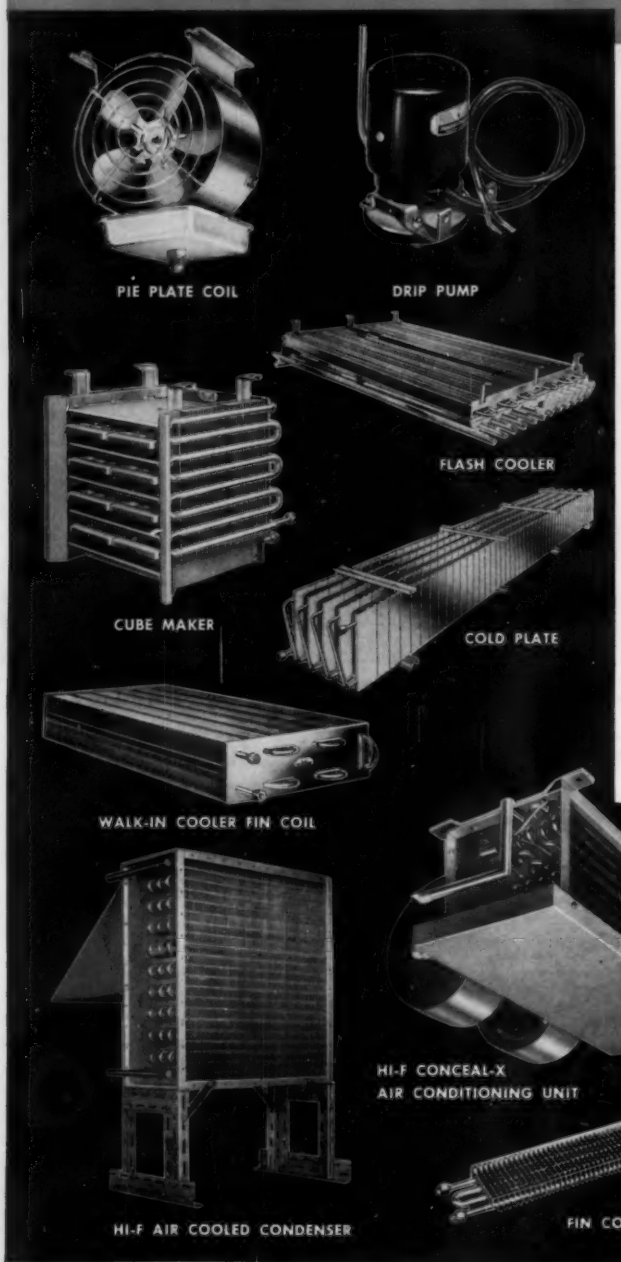
For economical, non-rusting plumbing specify ANACONDA Copper Tubes and ANACONDA Solder-Type Fittings. A wide range of sizes are stocked by Anaconda distributors throughout the country. Descriptive literature is available. Write to *The American Brass Company, Waterbury 20, Conn.* In Canada: *Anaconda American Brass Ltd., New Toronto, Ontario.* 3511

for copper tubes see your

ANACONDA®

distributor

THE COMPLETE PEERLESS LINE
FAMOUS FOR
BUILT-IN SATISFACTION



In Peerless you not only satisfy your customers' needs in coils, but you also give the extra advantages found only in Peerless Products, the result of 43 years experience in manufacturing coils of all types and exclusive features of design and construction. These features mean continuous satisfaction year after year because of a constant B. T. U. capacity rate.

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MANUFACTURERS NOTE: *Send us blueprints of your evaporator and condenser requirements for quotation. Please indicate delivery requirements.*

PEERLESS OF AMERICA, INC.

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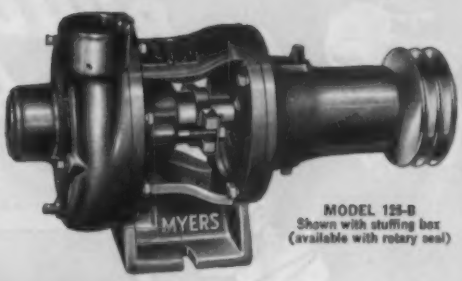
MODEL 125-M
Shown with stuffing box
(available with rotary seal)



MODEL 125-B
Shown with stuffing box
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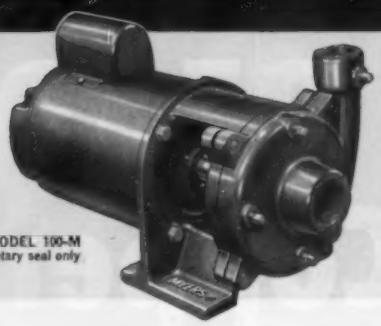
NOW...a complete line
of centrifugal pumps for air conditioning from...
MYERS

MODEL 100-B
Rotary seal only



MODEL 100-M
Rotary seal only

FULL RANGE OF SIZES
⅓, ½, ¾, 1, 2, and 3 horsepower, motor-mounted or belt-driven models.

TWO CASING SIZES
1″ x 1¼″ or 1¼ x 1½″.

ALL-BRONZE IMPELLER
Accurately balanced for smooth operation.

REMOVABLE BRONZE WEARING RINGS
Easily replaced for longer pump life.

ROTARY SEAL
Eliminates leakage (stuffing box may be specified on "125" models.)

CORROSION-RESISTANT SHAFT
Stainless steel for trouble-free service.

WIDE RANGE OF CAPACITIES AND HEADS
Capacities to 90 GPM. Heads up to 135 feet.

Write today *for Bulletin 210 on* Myers *Centri-Thrift Pumps.*

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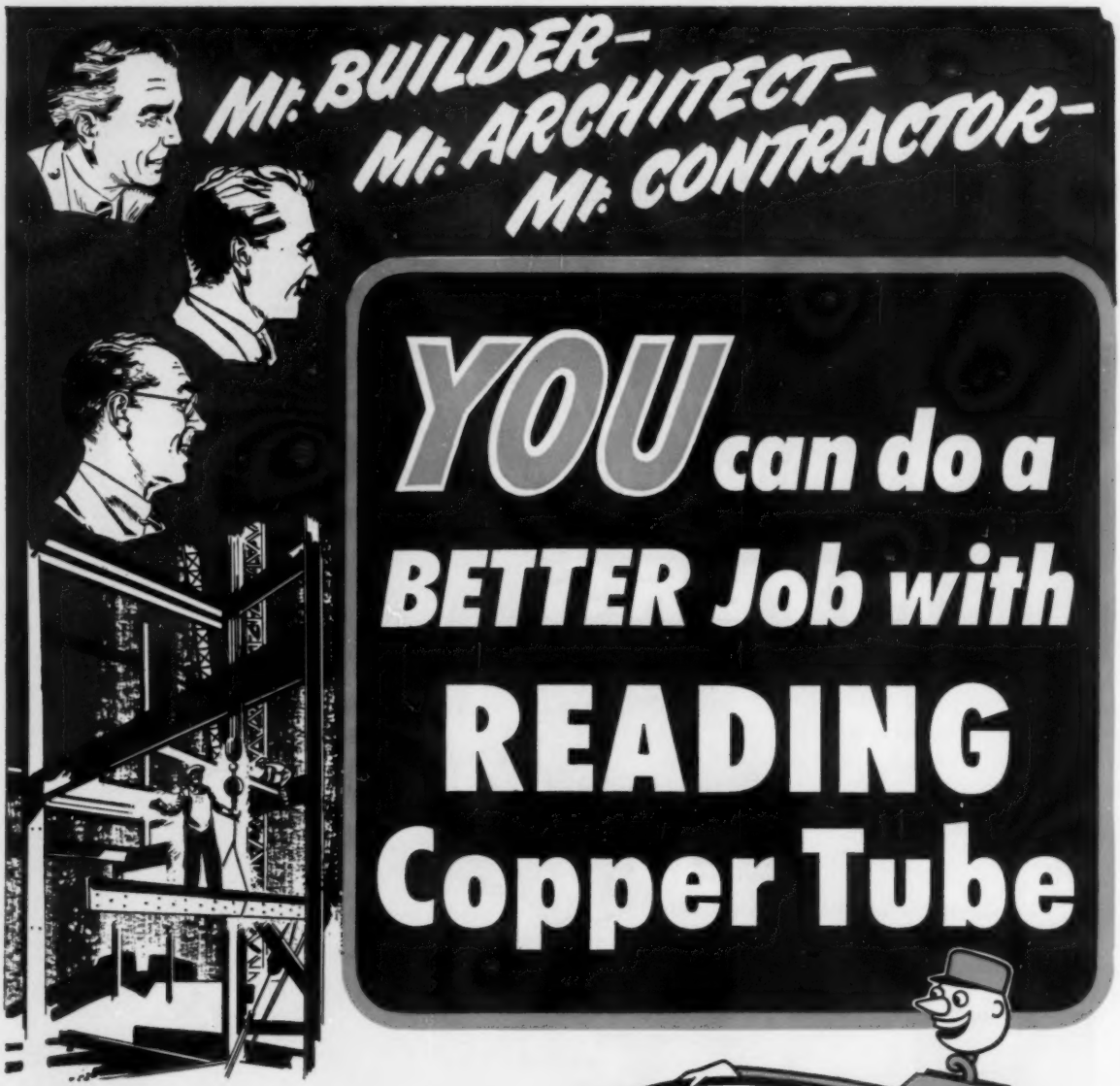
PUMPS WATER SYSTEMS AND WATER SOFTENERS

The F. E. Myers & Bro. Co., Dept. HP-11, Ashland, Ohio



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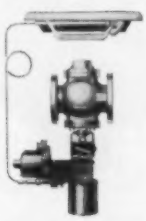
Modulating Controls for hot water and radiant heating



Modulating Controls for steam heating

Type AO Controls for hot water and radiant heating

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finned-tube and baseboard radiation

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NO SINGLE WELDER WILL DO IT ALL!

THERE'S EXACTLY
THE RIGHT **miller** WELDER
TO MEET EVERY WELDING REQUIREMENT

MILLER SR RECTIFIER TYPE DC ARC WELDERS

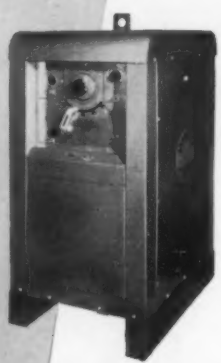
Available in 200, 300, 400 and 600 amperes, it is a superior direct current welder using Miller Unitran transformer control and selenium rectifiers for conversion from 3 phase AC line current. Miller SR Welders feature widest possible current range, extreme arc flexibility, maximum electrode deposition rate and highest electrical efficiency.

THE *New* MILLER SRH RECTIFIER TYPE DC ARC WELDER

A new concept in welder design for all DC metalic arc welding. Available in 200, 300 and 400 amperes. It is ruggedly constructed, compact, and is designed to lend itself to stacking for parallel operation or to conserve floor space. It has single range control and is weatherproof.

MILLER ARC WELDERS FOR TUNGSTEN ARC WELDING PROCESS

These Miller Welders feature the patented Miller UNITRAN control circuit which combines the transformer with its own integral flux diverter. This, in conjunction with adequate open circuit voltage, high frequency, balancing resistor and optional controls insures superior uniformity and flexibility throughout the entire welding range. Available in nine models.



THE *New* MILLER MULTI ARC COMBINATION AC-DC WELDER

Available in 14 models, this new Miller Welder provides both AC and DC welding power for applications where both are required. It operates from a single phase power line and is available with high frequency and controls designed especially for inert gas arc and spot welding.

MILLER 100 SERIES HEAVY DUTY INDUSTRIAL TYPE AC WELDERS

Designed for heavy production welding and automatic welding applications. Available in eight models. The 100 Series Welders permit faster welding—as much as 35% faster. Movable coil design and 80 volts O.C.V. produces uniform and better welding characteristics throughout the entire range of the welder.

Write today for complete information on these Miller Welders.

ARC-SPOT miller GENERATORS WELDERS

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ELECTRIC MANUFACTURING CO., INC.
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"... if it's MILLER you know it's the finest..."

How to kill three duct problems

with one insulation . . .

Thermal, acoustical and vapor barrier problems are "dead ducks" when you use ULTRALITE*, the long glass fiber insulation. Here's why: Due to its unique long glass fiber composition, ULTRALITE is the toughest, most resilient glass fiber insulation on the market, with a record of ten years of successful application. Because of this extra strength, it can be adhered to sheet metal and run through the brakes and shears at the same time the ducts are formed — without worry that it will tear, compress, or delaminate.

Ducts formed in this way are *completely insulated units*, ready to install on the job. They solve the noise problem without impairing the efficiency of the unit because ULTRALITE Duct Liner has a low air friction coefficient. The same insulation that soaks up objectionable sound also insulates the ducts against heat gain or loss. *No vapor barrier is necessary;* with the insulation on the *inside* of the duct, the duct itself becomes the vapor barrier.

Try this time-saving new method on your next job, and you'll be delighted with both cost and performance. But be sure to use ULTRALITE — the only flexible glass fiber insulation with a 10-year record of successful performance.

*Reg. U. S. Pat. Off.

NOTE

Should you continue to wrap ULTRALITE around the exterior of ducts for thermal protection, be sure to line the plenum and short supply and return ducts with ULTRALITE Duct Liner. Do so even on jobs where duct liner is not specified, and you will be well repaid, for this will make all the difference between an enthusiastic and a dissatisfied customer.

ULTRALITE is stocked locally in 57 cities. Your nearby distributor is listed in the Yellow Pages under "Gustin-Bacon Insulations."

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Thermal and acoustical glass fiber insulations • Pipe couplings and fittings • Railroad gaskets and supplies

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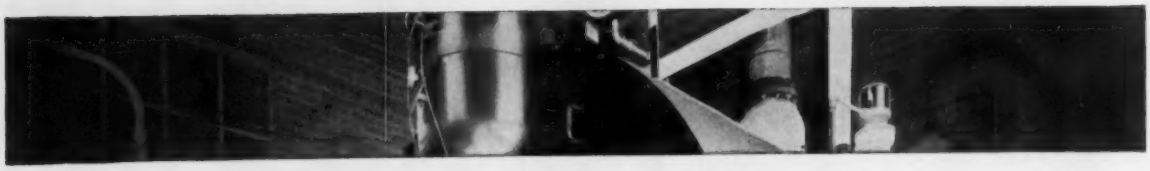
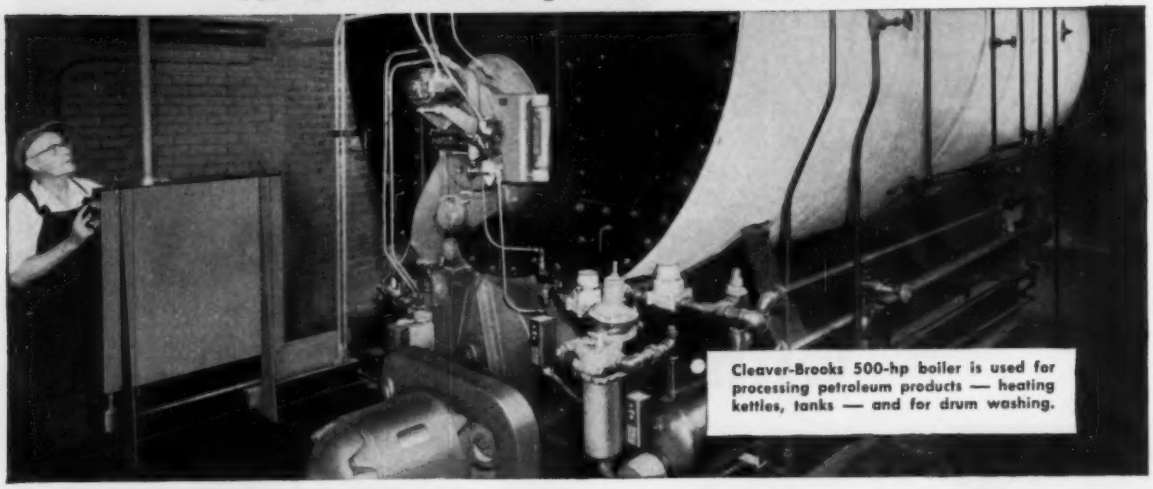


"We heard Cleaver-Brooks Boilers were OK"

. . . and what an understatement that proved to be for a Milwaukee petroleum marketer*



Cleaver-Brooks 500-hp boiler is used for processing petroleum products — heating kettles, tanks — and for drum washing.

Look at the record:

350 gallons of fuel oil saved per day!

On an annual basis — that's more than 90,000 gallons of oil saved.

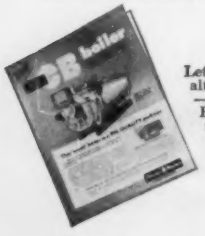
Complete shutdown flexibility with the assurance of fast steaming from a cold start is the key to these remarkable savings for a petroleum processor and marketer in Milwaukee, Wisconsin. Now, a Cleaver-Brooks 500-hp boiler operates 10 hours a day, 5 days a week, where formerly two 150-hp units operated continuously 24 hours a day, 7 days a week. Fewer boiler working hours also saves up to $11,000 yearly in maintenance.

By replacing outmoded equipment, this petroleum processor also enjoys the benefits of guaranteed 80% operating efficiency, four-pass design, forced draft, 5 sq. ft. of heating surface per boiler-hp and fully-automatic firing. Cleaver-Brooks Company, Dept. M, 313 E. Keefe Ave., Milwaukee 12, Wisconsin — Cable Address: CLEBRO — Milwaukee — all codes.

**Name supplied upon request.*

Look at these "before-and-after" facts

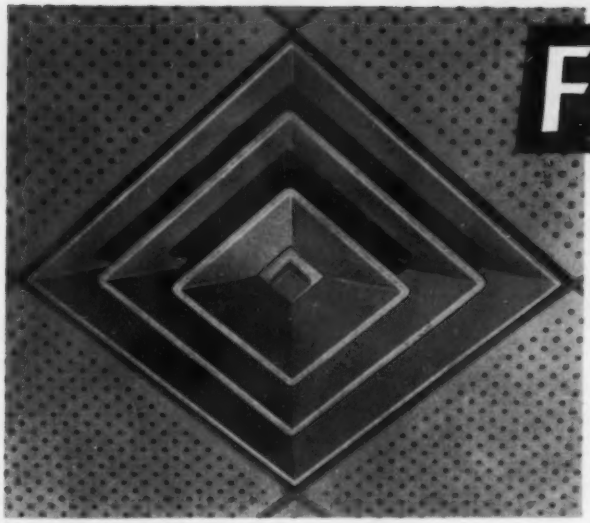
	NEW (1) 500-hp Cleaver-Brooks boiler	OLD (2) 150-hp obsolete boilers
FUEL CONSUMPTION	450 gal. per day (10-hr. day) 46 gal. per hour (operating hour)	800 gal. per day (24-hr. day) 60 gal. per hour (operating hour)
SCHEDULED STEAM SERVICE	Automatic firing from 6:30 a.m. to 4:30 p.m. Fast steaming from a cold start.	Continuous 24-hr. operation. Couldn't shut down. Wasted heat. No benefit from extra hours of operation.
OVERALL EFFICIENCY	Average 125 lb. of steam per gal. of oil.	Average 96 lb. of steam per gal. of oil.
OVERALL MAINTENANCE	Cleaned every 6 months. Single maintenance foreman.	Cleaned every 6 weeks. Required extra fireman for weekends.



Let us help you beat the penalties of boiler obsolescence — with a modern Cleaver-Brooks installation. Sizes from 15 to 600 hp, 15 to 250 psi — steam or hot water, for heating or processing. Write for catalog.

Cleaver Brooks 25th YEAR

TWENTY-FIVE YEARS OF LEADERSHIP BY THE ORIGINATORS OF THE SELF-CONTAINED BOILER



FLEXIFLO

AIR DIFFUSERS

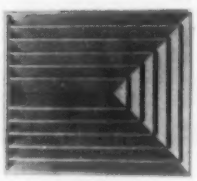
for Matchless Performance and Beauty

SQUARE HAR Series with adjustable vanes for volume control.

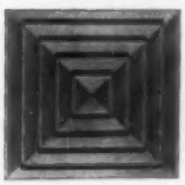
RECTANGULAR
Type MP

ONE-WAY

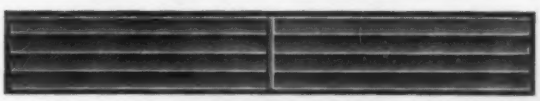
TWO-WAY



THREE-WAY



FOUR-WAY



MPL straight line diffusers are outlets designed for use as separate units or continuous strips.

The FLEXIFLO Types HARC and HART adjustable square diffusers answer a long felt need for outlets to provide complete adjustability with unvarying air pattern. The effective area of the FLEXIFLO is infinitely variable. Because all blades move simultaneously when the control knob is moved up or down, air volume can be controlled with great precision.

FLEXIFLO TYPE MP diffusers are made to order in all rectangular shapes for 1-, 2-, 3- and 4-way blows to accommodate rooms of irregular shape. The diffusion pattern, because of the special construction and angle of the horizontally tipped vanes, is parallel to the ceiling in all cases. Fast air mixture and temperature equalization are assured. Supply air, passing through the wide openings between the vanes, is not inhibited by unnecessary obstructions, thus affording extremely quiet operation at recommended neck velocities.

Write for Flexiflo Manuals

UNIVERSAL DIFFUSER CORPORATION HP
1360 Garrison Avenue, New York 59, N. Y.

Please send me Flexiflo Manual on

☐ Square & Rectangular Diffusers ☐ Circular Diffusers

NAME_____

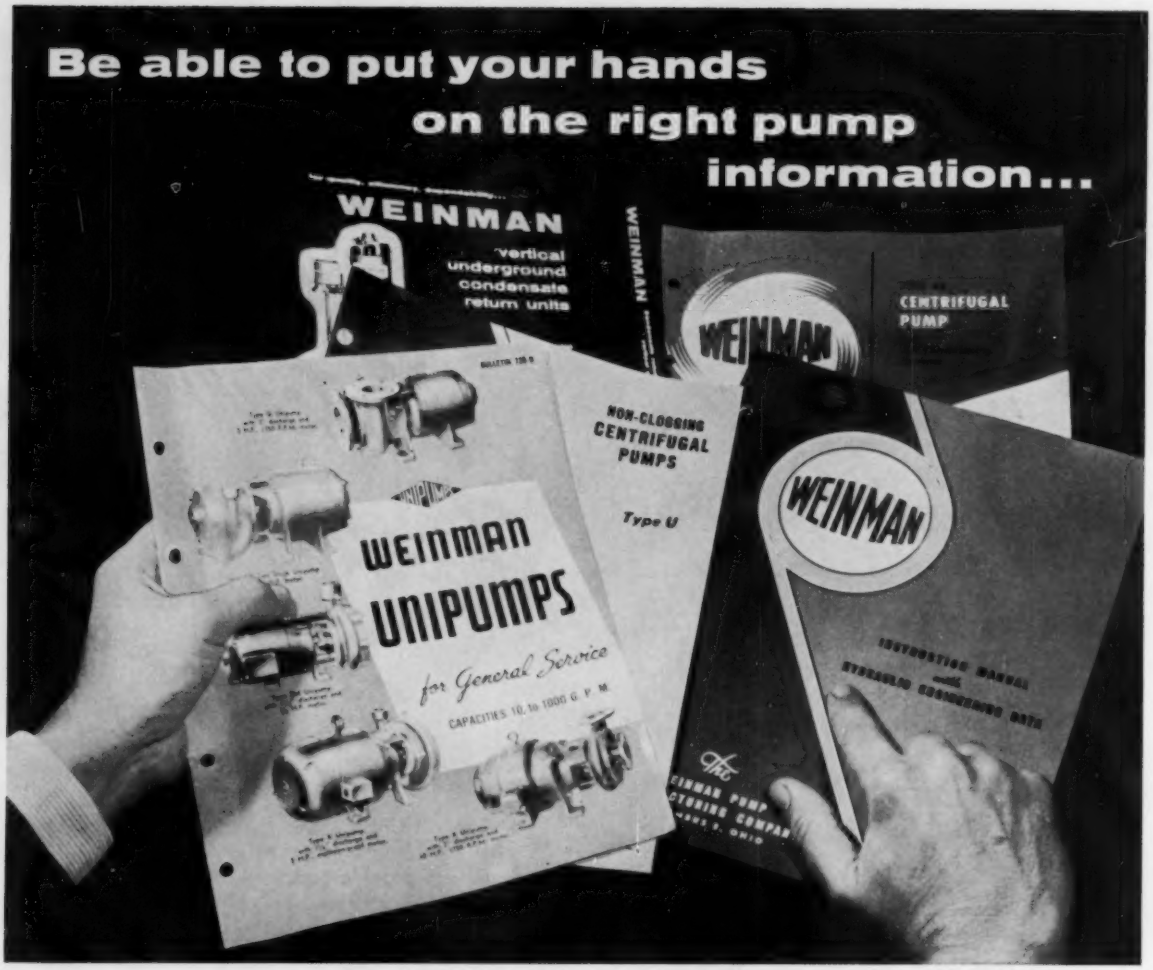
COMPANY_____

STREET_____

CITY_____ STATE_____

FLEXIFLO

UNIVERSAL DIFFUSER CORP.
1360 GARRISON AVE., NEW YORK 59, N.Y.



for Heating and Air Conditioning Jobs

Perhaps you have a place for a dependable WEINMAN pump unit, *right now*—or are considering future applications. If so, you'll want these NEW WEINMAN bulletins to aid you in determining the BEST type of pump for the job you want to do.

From impeller to shaft seal, WEINMAN pumps are built better—for WEINMAN quality is *built-in!* That built-in quality adds up to dependable pumping efficiency for every job in your field—with WEINMAN.

Let a Weinman Centrifugal Pump Specialist help you solve YOUR pumping problems

No matter where you are, there's a qualified WEINMAN Centrifugal Pump Specialist who will gladly lend you a helping hand. See your telephone book yellow pages — or write for name of nearest representative.

SEND FOR BULLETINS NOW!

THE WEINMAN PUMP MFG. CO.

Send me these bulletins

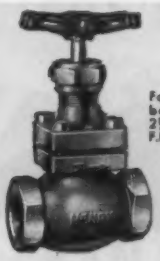
- ☐ Instruction Manual with Hydraulic Engineering Data
- ☐ W-11 Condensate Return Unit to 40,000 EDR
- ☐ 726-D Close Coupled Unipumps for General Service
- ☐ 725 Type AC pump for Air Conditioning Systems

NAME

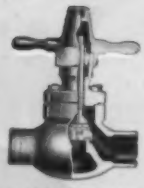
ADDRESS

CITY STATE

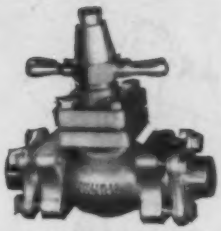
PACKLESS VALVE
With balanced-action. Sizes ¼" through ⅜" FL, ¼" through 1⅜" O.D.S.



AMMONIA VALVE
Forged steel or semi-steel bodies. Sizes ¼" through 2½" F.P.T., 1¼" through 6" F.P.T. slip-on welding or welding neck flanges.



WING CAP VALVE
Non-ferrous. Sizes ⅜" through 4⅛" O.D.S.



WING CAP VALVE
Semi-steel screwed or flanged types. Sizes 1¼" through 6".

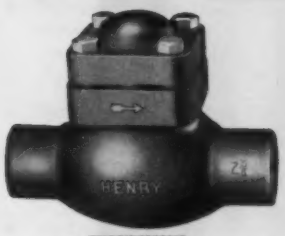
HENRY VALVE CO.
CONTROLLING FLOW

you pay—
no premium for..
the extra advantages found in
Henry products
or for the extra satisfaction that follows their use

STRAINER
Angle type with patented distortion-type flange. Sizes ⅜" through 4⅛" O.D.S., 2½" through 4" butt weld.

Y-STRAINER
Brass plated. Welded steel construction. Forged brass connections. Sizes ⅜" through 4⅛" O.D.S., 2½" through 4" butt weld.

BALANCED-ACTION PACKLESS LIQUID LEVEL GAUGES
Valves are backseating—diaphragms may be inspected or replaced without loss of liquid. Conforms with all safety code requirements. Also packed types, capped or with hand wheels.



CHECK VALVE
Piston Type For Freon. Sizes ⅜" through 4⅛" O.D.S.

DRIER
Cartridge type 12 to 500 cu. in. capacity. Sizes ⅜" to 2⅛" O.D.S

DRIER
Large diameter and capacity. All brass construction. Minimum pressure drop.

UV NB

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No. 101 Packless and packed valves, strainers, driers, check valves, relief valves, three-way valves, liquid gauge sets, flange unions and accessories for air conditioning, refrigeration and industrial uses.

No. 201 Ammonia valves and accessories.

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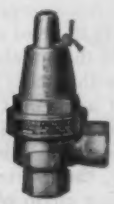

DIAPHRAGM RELIEF VALVE
Operates independently of outlet pressure permitting use of rupture disc assembly on outlet side without increasing initial leak pressure. Forged brass bodies. Sizes, ⅜" & ½" I.P.S., ½" & ⅝" O.D.S.

STRAIGHT-THROUGH RELIEF VALVE
Large capacity—All brass construction. Sizes ½" through 1" P.T. Meet A.S.M.E. standards, National Board Certified. Other sizes and types available.

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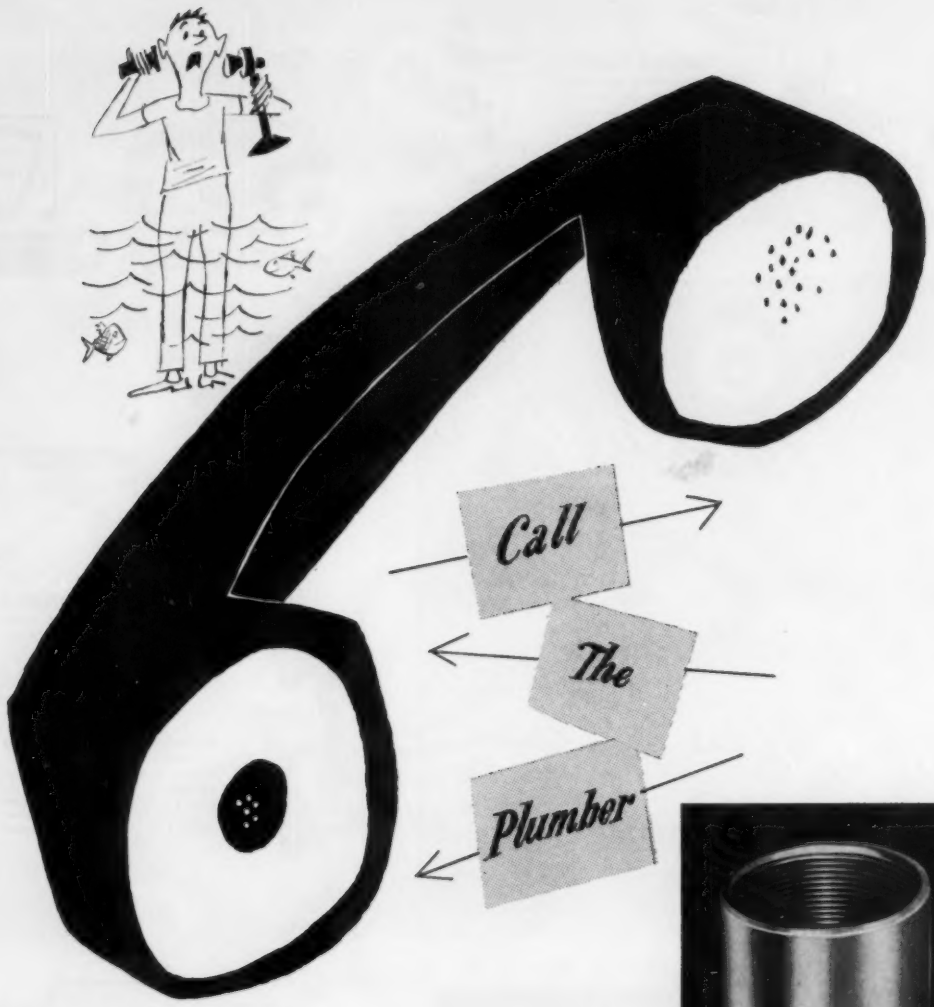

and good plumbers everywhere call for

WHEATLAND STEEL PIPE

When things go wrong, when the emergency calls go out, there is always a plumber ready to be of service to the ailing house. And behind the plumber stands the distributor ready to serve with quality products at a moment's notice.

The Wheatland Tube Company, makers of Wheatland Steel Pipe, form part of this service picture. By dependable service and quality, they form part of this never ending chain of service.

WHEATLAND TUBE COMPANY

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THERE'S A STAYNEW VENTILATION PANEL FILTER

FOR EVERY TYPE OF COMMERCIAL AND INDUSTRIAL SERVICE

Ventilation and air conditioning engineers recognize the Model WKE dry-panel filter as the most efficient unit of its kind on the market today. Wide range of media is available — it operates at maximum efficiency with any medium that comes in sheet form and can be crimped. Because of its extreme versatility, the Staynew WKE filter may be used for hundreds of varied applications.

- Greater filtering area, size for size, than competitive panels.
- Construction permits wide selection of filtering media.
- Wire screen cloth front and back of medium eliminates "sagging" and protects it so that even the most fragile materials can be cleaned over and over again.
- Can be cleaned quicker than any other type panel.
- Can be washed or dry cleaned when necessary.
- Medium can be replaced quicker than in any other panel.

Inexpensive disposable media can be furnished, if desired.

MODEL WKE Dry Panel Filter Available in 2", 4", and 8" Deep Units

One exclusive advantage with the Staynew WKE is that it can be easily vacuum-cleaned in place. Saves time—reduces maintenance costs.

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9 Centre Pk., Rochester 3, N. Y.

ALL TYPES OF FILTERS FOR EVERY INDUSTRIAL NEED

quiet as a flame!

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GAS VALVE

You'll have– **MORE SATISFIED CUSTOMERS . . . MORE PROFITS**

ACCEPTED BY ALL UTILITIES

with V-579 Gas Valves by DETROIT CONTROLS. No click, no hum, no noise because the V-579 is operated by positive opening, positive closing "Biflex" motor!

Install these V-579 gas valves close to living rooms or sleeping rooms, secure in the knowledge that they will operate dependably and *quietly*. Their operation is independent of gas pressure and gravity. Ideal for *all* types of gas, in any domestic heating unit! ½ inch to 1¼ inch sizes.

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DETROIT CONTROLS CORP. manufactures a complete line for the air conditioning and refrigeration industries as well as heating.

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AUTOMATIC CONTROLS *for* REFRIGERATION
AIR CONDITIONING • DOMESTIC HEATING • AVIATION • TRANSPORTATION • HOME APPLIANCES • INDUSTRIAL USES

Here's the only tool you need for all stud fastenings

New Double-Duty

REMINGTON STUD DRIVER

Sets both ¼" and ⅜" studs in steel or concrete—in seconds!

Light-, medium- or heavy-duty fastening, the new Model 455 Remington Stud Driver speeds the job. It sets *two* different size studs... up to 6 studs per minute, either size . . . and offers new possibilities in anchoring conduit clips, steel frames, wood forms and many other fixtures.

Powerful 22 and 32 caliber cartridges drive ¼" and ⅜" studs *solidly* into steel or concrete. For special medium-duty work, the smaller cartridge is used with the larger stud. Result: the greatest flexibility ever in a cartridge-powered tool! Just clip coupon for details.

"If It's Remington—It's Right!"

Remington DUPONT

Only 90 seconds to change barrels

Easy change from one stud size to the other right on the job!

MAIL THIS COUPON TODAY

Industrial Sales Division
Remington Arms Co., Inc., Bridgeport 2, Conn.

Please send me your free booklet which shows where and how to use the cost-saving Remington Stud Driver fastening method.

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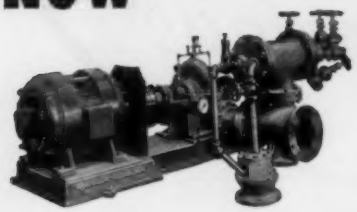
*Firm*_____

*Address*_____

*City*_____ *State*_____

HPAC-11

PROVIDE FOR FIRE PROTECTION NOW



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WHEELER-ECONOMY FIRE PUMP

A delay in the planning or completion of your fire protection program may mean loss of life, property or operation. For a complete and effective plan include one or more Underwriters Laboratory and Factory Mutual Fire Insurance Companies approved Wheeler-Economy Fire Pumps.

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WE-550

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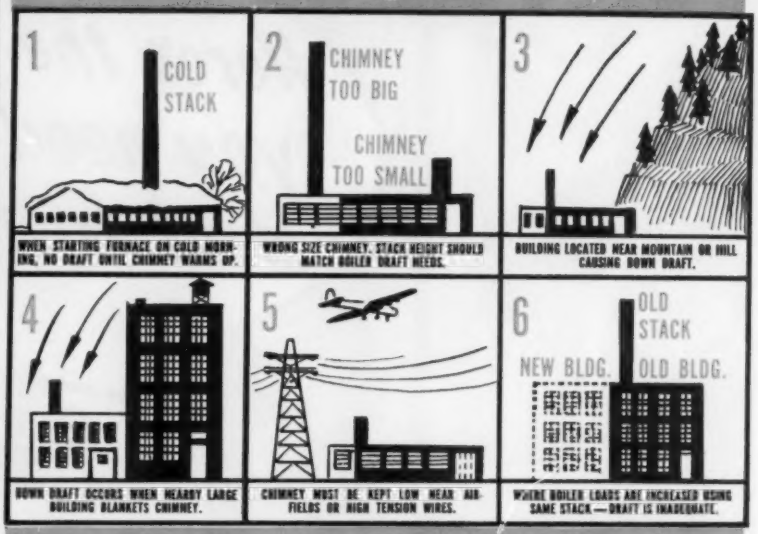
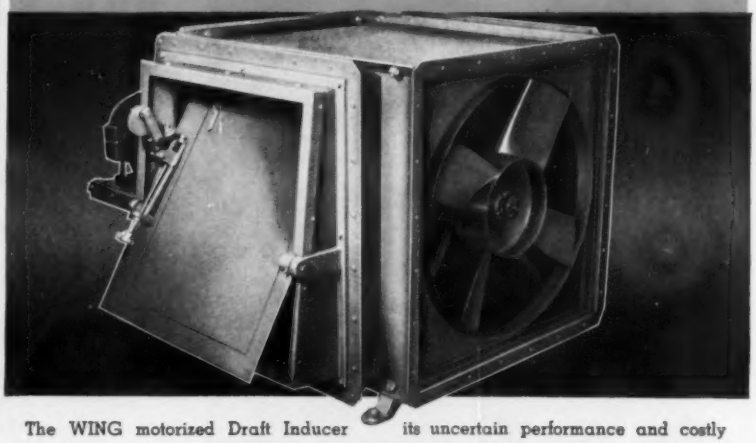
HOW TO OVERCOME THESE SIX CAUSES OF POOR DRAFT


1
COLD STACK
WHEN STARTING FURNACE ON COLD MORNING, NO DRAFT UNTIL CHIMNEY WARMS UP.
2
CHIMNEY TOO BIG
CHIMNEY TOO SMALL
WRONG SIZE CHIMNEY. STACK HEIGHT SHOULD MATCH BOILER DRAFT NEEDS.
3
BUILDING LOCATED NEAR MOUNTAIN OR HILL CAUSING DOWN DRAFT.
4
DOWN DRAFT OCCURS WHEN NEARBY LARGE BUILDING BLANKETS CHIMNEY.
5
CHIMNEY MUST BE KEPT LOW NEAR AIRFIELDS OR HIGH TENSION WIRES.
6
OLD STACK
NEW BLDG.
OLD BLDG.
WHERE BOILER LOADS ARE INCREASED USING SAME STACK—DRAFT IS INADEQUATE.

USE THIS WING DRAFT INDUCER



The WING motorized Draft Inducer provides positive, adequate, uniform draft at all times regardless of wind, weather or variation in boiler load. Eliminates need for high chimney with its uncertain performance and costly upkeep. Cuts fuel cost by giving higher CO_2's. Wing Draft Inducers are easy to install and require little maintenance. Write for Bulletin today. Use the coupon.

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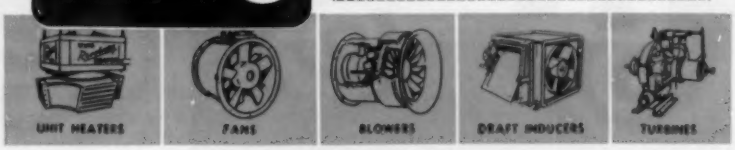
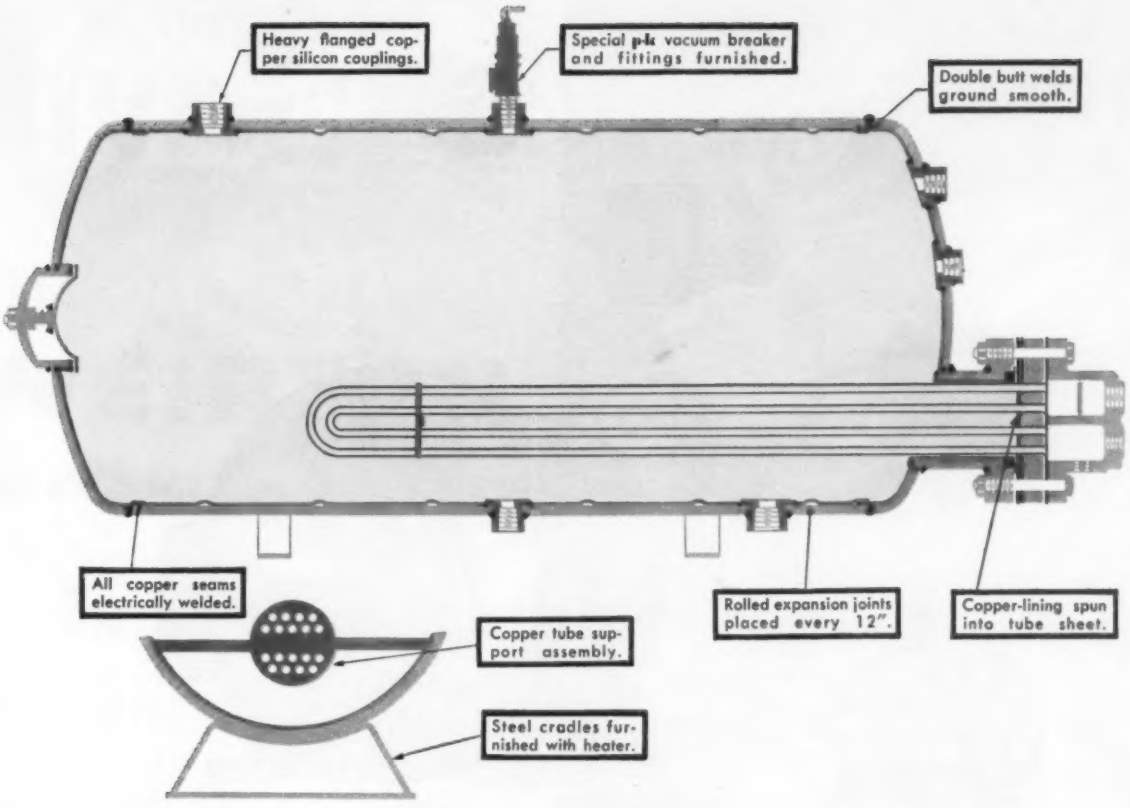
Factories: Linden, N.J. & Montreal, Can.

Wing

L. J. Wing Mfg. Co., Linden, N. J. HP-11
Please send me Bulletin I-55—Draft Inducers
Name.....
Firm.....
Address.....
City.....Zone.....State.....




Heavy flanged copper silicon couplings.
Special p-k vacuum breaker and fittings furnished.
Double butt welds ground smooth.
All copper seams electrically welded.
Rolled expansion joints placed every 12".
Copper-lining spun into tube sheet.
Copper tube support assembly.
Steel cradles furnished with heater.

WHAT TO LOOK FOR IN A *Copper-Lined* HEATER

Nearly everyone knows the advantages of a copper-lined heater. Few realize the importance of the design features that are essential to long life and trouble-free service.

When you have manufactured a quality product for more than 40 years... built more than any other fabricator... and have thousands of successful installations from coast to coast, you know that product: how to build it *right* . . . economically . . . and with every possible design feature that 40 years experience shows is necessary.

Some of **p-k**'s experience is indicated in the diagram above. In the lining of this **p-k** heater, for instance, rolled joints are used at regular intervals around the full circumference, to allow for longitudinal expansion. Heavy flanged copper silicon couplings are securely welded to both the shell and the lining.

Standard equipment includes a special **p-k** vacuum breaker to protect the lining from sudden pressure fluctuation.

Another very important point is the testing of all **p-k** copper-lined heaters to insure long trouble-free service. Separate hydrostatic and pneumatic tests are made to guarantee leak-proof linings.

Experienced engineers know these points are critical. They know, too, that there is no substitute for this painstaking **p-k** type of construction . . . and that *insisting on* and *specifying* these construction points in copper-lined heaters justifies itself over and over again.

For complete copper-lined data write to The Patterson-Kelley Company, 810 Burson Street, East Stroudsburg, Pa.

PATTERSON-KELLEY

2569

Offices: 101 Park Avenue, New York 17 • Railway Exchange Building, Chicago 4 • 1700 Walnut Street, Philadelphia 3 • 96-A Huntington Avenue, Boston 16 and other principal cities

NEW *Totally Protected* MOTORS NOW AVAILABLE

Complete line of the NEW Reliance Totally-Protected A-c. Motors is IMMEDIATELY available.

These star performers combine maximum physical strength and protective enclosure. Starting and full load torques in excess of NEMA standards . . . built-in reserves to meet *extra* production loads.

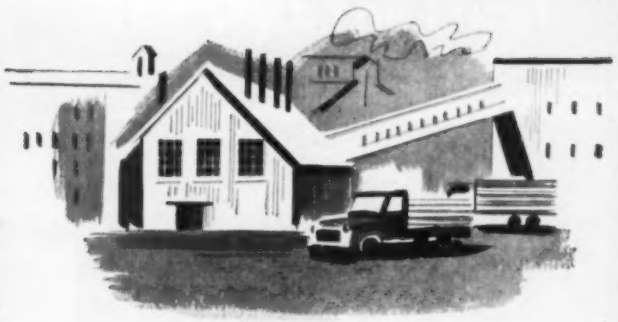
Mount the new compact NEMA Frames where ever you have an application for an a-c. motor of 1 to 40 horsepower. All types of mountings . . . frame sizes 182 to 326-S.

Reliance Motors are *totally protected from core to cover* . . . rotating components and active material are carefully treated and assembled to assure a lifetime of trouble-free continuous performance.

Let us put these star performers to work for you—write for complete information. B-1660

RELIANCE ELECTRIC AND ENGINEERING CO.

Cleveland 10, Ohio • Offices in Principal Cities
Canadian Division: Welland, Ontario



WEIRTON

GALVANIZED SHEETS

for long-lived roofing and siding

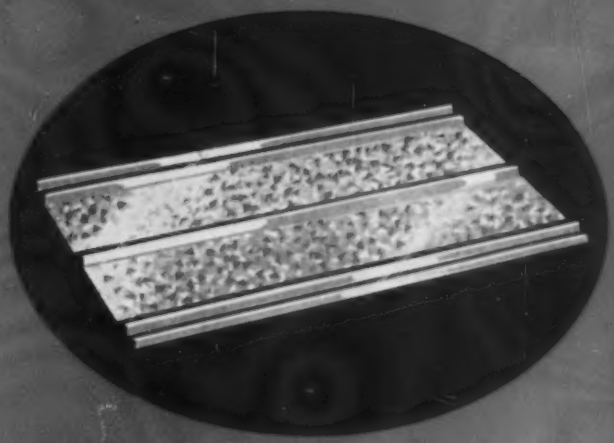
There's an easy way to solve roofing and siding problems quickly, dependably, economically. That's the Weirton way—with Weirton galvanized steel sheets. Their tight zinc coating resists cracking, peeling and flaking. The strength of steel plus the corrosion resistance of zinc gives added years of life. And long experience shows that galvanized sheets give more protection, with less maintenance and at lower cost.

Weirton's modern production processes, plus close quality control all along the line, make Weirton galvanized sheets a best buy for your roofing and siding needs.

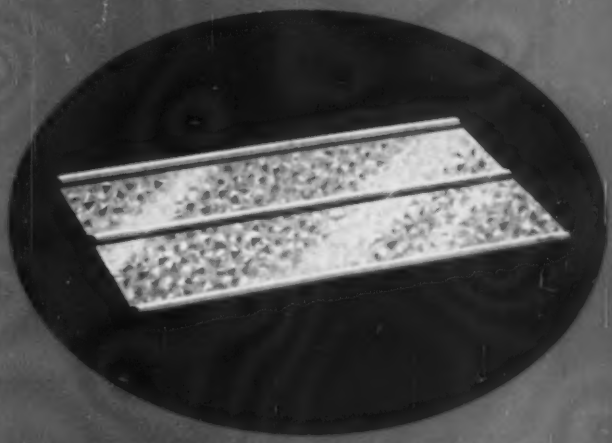
WEIRTON STEEL COMPANY

Weirton, West Virginia

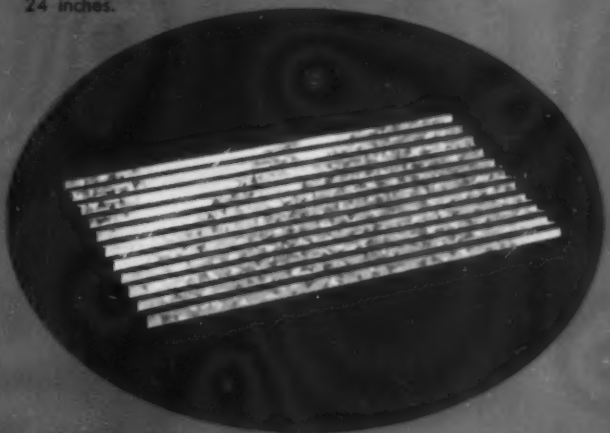
NATIONAL STEEL CORPORATION



Famous Weirton "Safety Drain" galvanized steel sheets combine maximum protection with outstanding good looks.



Weirton galvanized V-Crimp sheets are made in 2V-, 3V-, and 5V-crimped, and in gauges 26, 28 and 29; covering width, 24 inches.



Weirton galvanized corrugated steel sheets are most economical in first cost, and are the strongest form of steel roofing because the corrugations strengthen the entire sheet.

Workmen of the Johnson Insulation Company, Detroit, Michigan, install Super·Fine on hot-air ducts at People's Outfitting Company's new store. Soft-textured blankets were quickly and easily wrapped around ducts and secured with light-gauge wire.

45,000 sq. ft. duct-insulation job proves . . .

L·O·F Super·Fine's strength and resiliency cut installation cost

Such important insulation savings as these can easily be obtained on your own duct jobs

On the big People's Outfitting Company store's duct-insulation job in Lincoln Park, Michigan, workmen averaged 500 square feet per man-day. This was possible

- because Super·Fine's great tensile strength, resiliency, and light weight make it easy to apply in hard-to-reach places;
- because workmen can pull it through narrow spaces close to ceiling without tearing;
- because workmen find the fine-textured blankets pleasant to handle;
- because the material cuts easily and can be wrapped around ducts quickly, without precision measuring or fitting;
- because no special tools or highly skilled labor are required.

L·O·F Super·Fine is highly efficient insulation. Millions of fine glass fibers and countless dead air cells effectively reduce heat loss. Glass fibers will not rot, decay, absorb moisture or support combustion.

It will pay you to figure L·O·F Super·Fine on your next job. Look in the Yellow Pages of your telephone directory for the name of your L·O·F Glass Fibers' distributor, or write: L·O·F Glass Fibers Company, Dept. 39-115, 1810 Madison Avenue, Toledo 1, Ohio.

L·O·F GLASS FIBERS

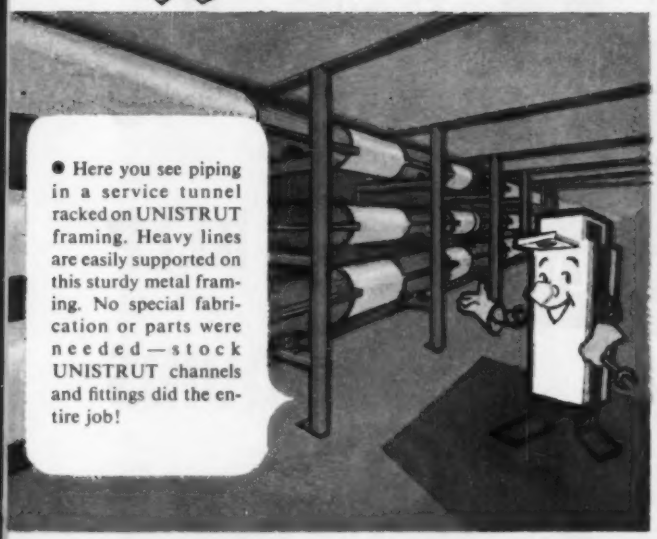
L·O·F GLASS FIBERS COMPANY
TOLEDO 1, OHIO
Makers of glass fibers by the exclusive "Electronic-Extrusion" process

SEND FOR FREE FOLDER giving performance data and specifications on L·O·F Super·Fine duct wrap and liner.

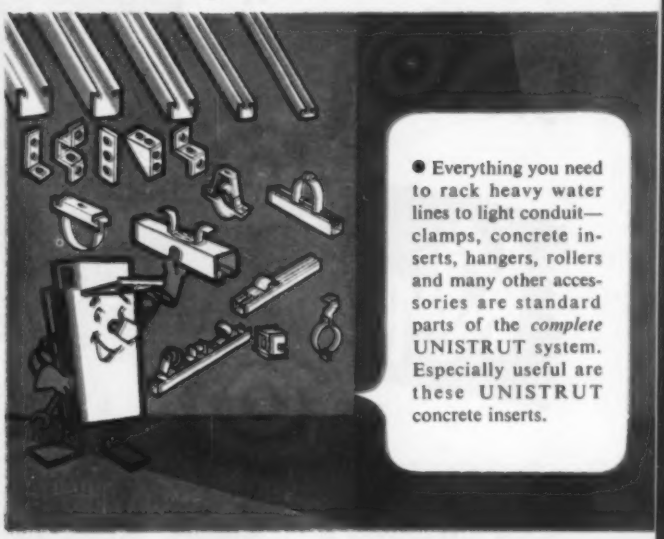
"The Sky's The Limit"

—when you build with UNISTRUT®

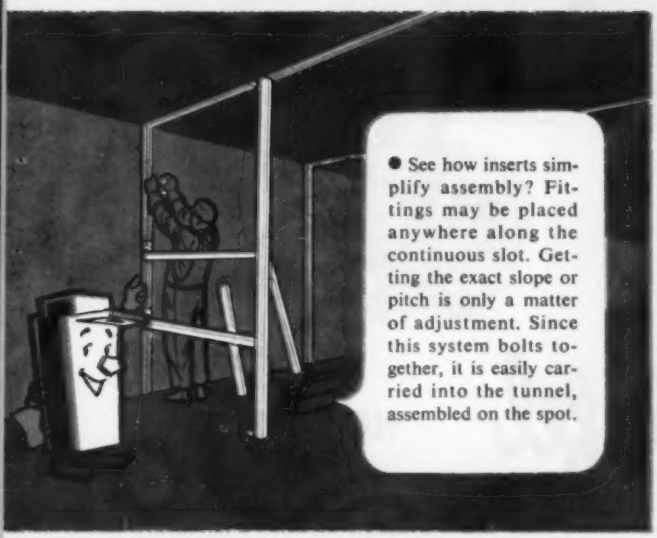
Mr. Strut simplifies pipe racking with cost-cutting UNISTRUT framing



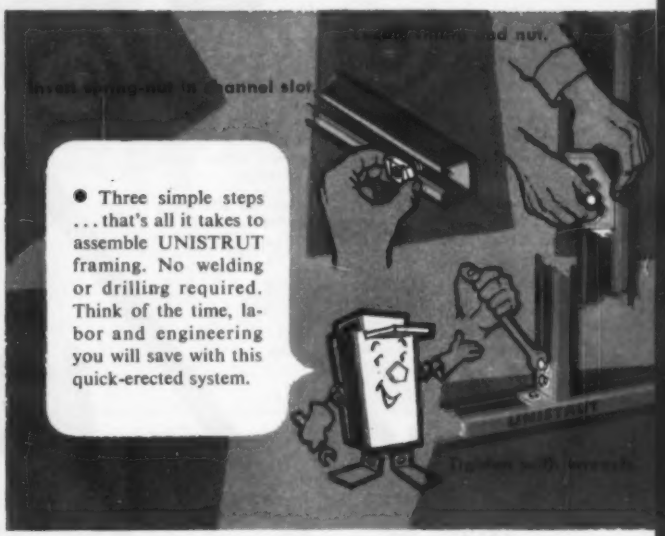
● Here you see piping in a service tunnel racked on UNISTRUT framing. Heavy lines are easily supported on this sturdy metal framing. No special fabrication or parts were needed—stock UNISTRUT channels and fittings did the entire job!



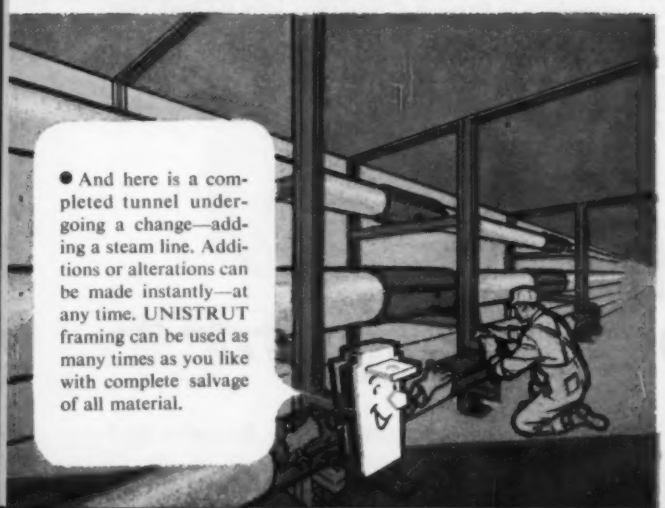
● Everything you need to rack heavy water lines to light conduit—clamps, concrete inserts, hangers, rollers and many other accessories are standard parts of the *complete* UNISTRUT system. Especially useful are these UNISTRUT concrete inserts.



● See how inserts simplify assembly? Fittings may be placed anywhere along the continuous slot. Getting the exact slope or pitch is only a matter of adjustment. Since this system bolts together, it is easily carried into the tunnel, assembled on the spot.



● Three simple steps ... that's all it takes to assemble UNISTRUT framing. No welding or drilling required. Think of the time, labor and engineering you will save with this quick-erected system.



● And here is a completed tunnel undergoing a change—adding a steam line. Additions or alterations can be made instantly—at any time. UNISTRUT framing can be used as many times as you like with complete salvage of all material.

Why not take advantage of this versatile system on your next job? You'll find it does a faster, better job for less money. Your UNISTRUT Distributor knows this system well and can assist you in design and engineering. See him for complete information and the new low price of UNISTRUT framing. Send the coupon below for free catalogs. Make a note, too, to see our latest film "The Sky's The Limit" —now at your UNISTRUT Distributor's.

Complete warehouse stocks in all principal cities. In Canada, Northern Electric Company.

The World's Most Flexible All-Purpose Metal Framing

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2327587 2380379
2329815 2405631
2345650 2541908
2363382 2696139
Other patents pending

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? ? DIAPHRAGM? STUFFING BOX? ?

NO!

? SPRINGS? ?

TO KEEP LIQUIDS ON-THE-LEVEL

Klipfel NO. 1 REDUCING VALVE

A forty year service record on steam lines throughout the land proves the Klipfel No. 1 Reducing Valve to be completely dependable . . . thoroughly trouble-proof. A piston and dash pot valve, the No. 1 has no springs . . . no diaphragm . . . no stuffing box . . . no trouble points. Oil filled dash pot prevents hunting, sudden valve movements and pressure fluctuations. Reduced pressure is easily adjusted by changing weight. Suitable for any reduced pressure between 10 and 150 pounds. Sizes 1-½ inch have screwed ends; larger sizes have either screwed or flanged ends.

Applications include main reduction to distributing head, auxiliary engines, vulcanizers, kettles, ironers, dryers, and pumps.

For complete details, write Dept. B-11 for Bulletin No. 154

Float Valves, Reducing Valves, Tank Thermostats, Back Pressure Valves Sold through wholesalers everywhere.

Klipfel FLOAT VALVES

- For liquid level control that's really automatic, depend on Klipfel Float Valves. They have a forty year record of dependability on thousands of installations, large and small, water and chemical, throughout the land.
- Available in direct acting or pilot control types, either single seated or double seated. Whatever your requirements of pressure, temperature, fluid and closure, there is a Klipfel Float Valve for the job.
- Also available with Klipfel's exclusive cup disc inner valve for tight control of liquids injurious to rubber and leather, and for higher pressures.

Klipfel VALVES, INC.
Division of Hamilton-Thomas Corp.
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Klipfel VALVES INC.

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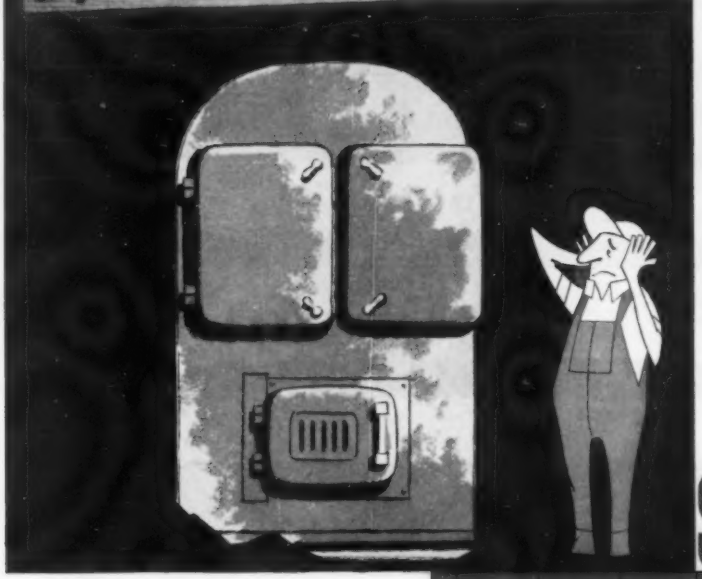
Export Dept., 1010 Schaff Bldg.
Philadelphia, Pa.

- **For complete details, write Dept. B-11 for Bulletin 254. Float Valves, Reducing Valves, Tank Thermostats, Back Pressure Valves.**

Are excessive "entry" costs knocking down your replacement volume?



Just think how many customers in your area would replace their worn-out boilers if it weren't for excessive installation costs. *You can get these jobs* if you . . .

install the unique

SPENCER "LW"

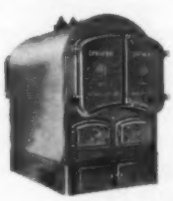
Built in two sections — permits easy entry through narrow basement openings. No tearing out of walls. The two watertight sections can be moved in separately, yet require no welding for installation.

Lower waterline — over-all height of the Spencer "LW" is approximately 25% less than conventional firebox boilers . . . makes possible use in low ceilinged basements . . . and therefore saves excavation expense!

Let Spencer build up your boiler business—write Dept. HP-115

OTHER COMMERCIAL BOILERS IN THE SPENCER LINE

New Spencer "C." Heavy-duty commercial boiler performance at a residential boiler price! Can be fired with oil, gas or coal.



Spencer "A." Complete range of sizes from 3,500 to 50,000 sq. ft. steam, net SBI ratings. For *every* building . . . for *every* fuel.

SPENCER HEATER
LYCOMING DIVISION
WILLIAMSPORT AVCO PENNSYLVANIA

ASME and SBI Approved

DURIRON ACID PROOF DRAIN PIPE

DURIRON is the *one* quality high silicon iron pipe specified for more than 30 years by architects and engineers for corrosive waste disposal systems. Specify DURIRON. Insist on DURIRON for resistance to practically all commercial acids and other corrosive solutions. It generally outlasts the building. A complete line of DURIRON pipe and fittings is stocked by leading wholesalers throughout the country. Free Bulletin PF/4.

THE DURIRON COMPANY, INC., DAYTON, OHIO

DURIRON
LOOK FOR THE NAME ON EVERY PIECE

Before you buy, or specify, look for this seal

CONVECTOR MANUFACTURERS' ASSOCIATION

The CMA is a trade association organized to maintain the quality of convector production, and the integrity of convector ratings.

No manufacturer may become a member of CMA without demonstrating ability to manufacture in accordance with the industry's code and the Association's standards.

All CMA members subscribe to the rating code for convectors as developed cooperatively by the Association and the National Bureau of Standards, U. S. Department of Commerce.

So, pick a brand with a seal — CMA It's your assurance of performance, of code-rated capacities, of quality, of dependability.

CMA **CONVECTOR MANUFACTURERS' ASSOCIATION**

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Airtherm Manufacturing Company
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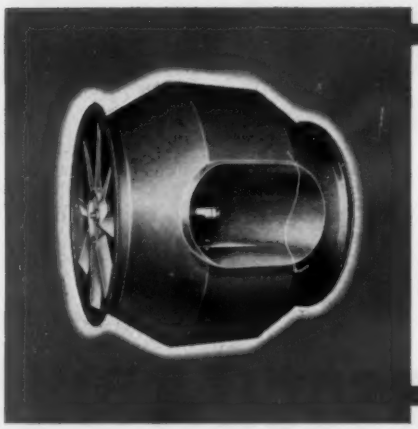
Modine Manufacturing Company
The Rome-Turney Radiator Company
The Trane Company
Tuttle & Bailey, Incorporated
Young Radiator Company

There's a HARTZELL Fan or Blower to Power Your Ventilating System

Hartzell Duct Fans

Say good-by to high installation and maintenance costs when you choose a Hartzell Duct Fan. Built as a prefabricated duct section, it bolts into place easily in any duct system, leaving the motor readily accessible for maintenance. This rugged and reliable fan fits any duct system for removal of flammable fumes, corrosive elements, or abrasive dust. Sizes from 12″ to 60″ in both belt-drive and direct-drive models.

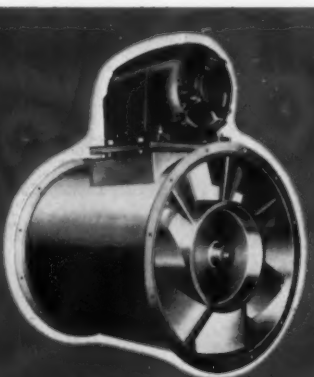


The *NEW* Hartzell Bi-Pass Duct Fan

Here is the ideal fan for high temperature operations such as ovens and oil and gas fired induced draft boilers and for moving corrosive fumes. Designed with the motor mounted in a tunnel out of the air stream, the Bi-Pass Duct Fan is available in diameters from 19″ to 41″. Operates in temperatures to 300° in standard construction, to 550° with special high-temperature, heavy duty construction.

Hartzell Vaneaxial Blowers

These rugged units are designed for trouble-free performance and long life in punishing industrial applications. All welded, heavy gauge steel construction. Ten belt drive sizes, 12″ to 54″, six direct drive sizes, 18″ to 42″. The new High-Temperature model moves air at temperatures up to 350° or air containing acids and alkalies without danger of premature failure of the belt or bearings. Other models operate efficiently against pressures as high as 10″ water gauge.



HARTZELL

Please send me details on
☐ Hartzell Duct Fans ☐ Vaneaxial Blowers
☐ The new Bi-Pass Duct Fan

Name _____
Company _____
Street & Number _____
City & State _____
If student, check here for special information ☐

propeller fan co.
Div. of Castle Hills Corp.
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PIQUA, OHIO

PROPELLER-TYPE FANS • BLOWERS
ROOF VENTILATORS • UNIT HEATERS

ENGINEERING OFFICES IN PRINCIPAL CITIES

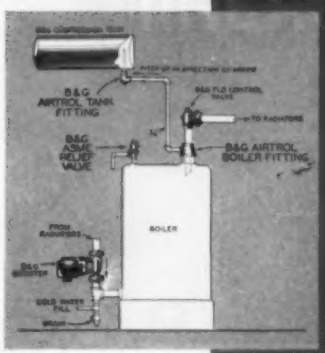
TWO WAYS TO END

CALL-BACKS

ON FORCED HOT WATER JOBS

B&G Airtrol System

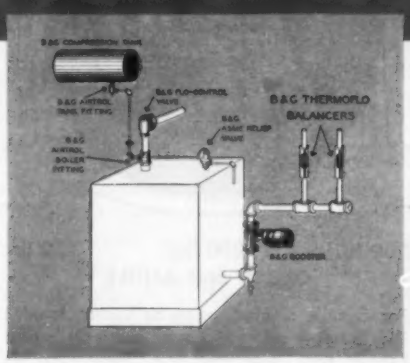
Eliminates air from hot water heating systems



Failure to heat—gurgling in the piping and heating units—water-logged compression tanks . . . these common troubles can be charged to *air in the system!* And charged also on your books as the reason for profitless call-backs!

Get rid of air troubles for good—with a B&G Airtrol System on every job. Tested and proved in thousands of installations, this B&G development eliminates air accumulation in forced hot water heating systems—solves a problem never before satisfactorily answered.

The B&G Airtrol System consists of two simple, easily installed parts—the Boiler Fitting and the Tank Fitting. Their combined function is to trap air in the compression tank and prevent its return to the boiler, piping and heat distributing units. All air bubbles are caught where they form—*in the boiler!*



B&G Thermoflo Balancer

For quick, easy balancing of forced hot water systems

If you make a little mistake in your pipe sizing calculations, the B&G Thermoflo Balancer will take care of everything!

With one of these units installed in each circuit, the entire system can be balanced to meet original design calculations. It not only shows you what's wrong but enables you to do something about it—*the easy way!* With the twist of a screwdriver you can correct pipe sizing errors—*reduce power consumption and operating costs.*

There's nothing like the Thermoflo Balancer on the market! Actual water flow is shown in GPM. The built-in thermometer permits a check of return water temperature to determine the heat output of the circuit. No more call-backs to remedy sluggish circulation or noise due to excessive flow rates...*the first adjustment is the last!*

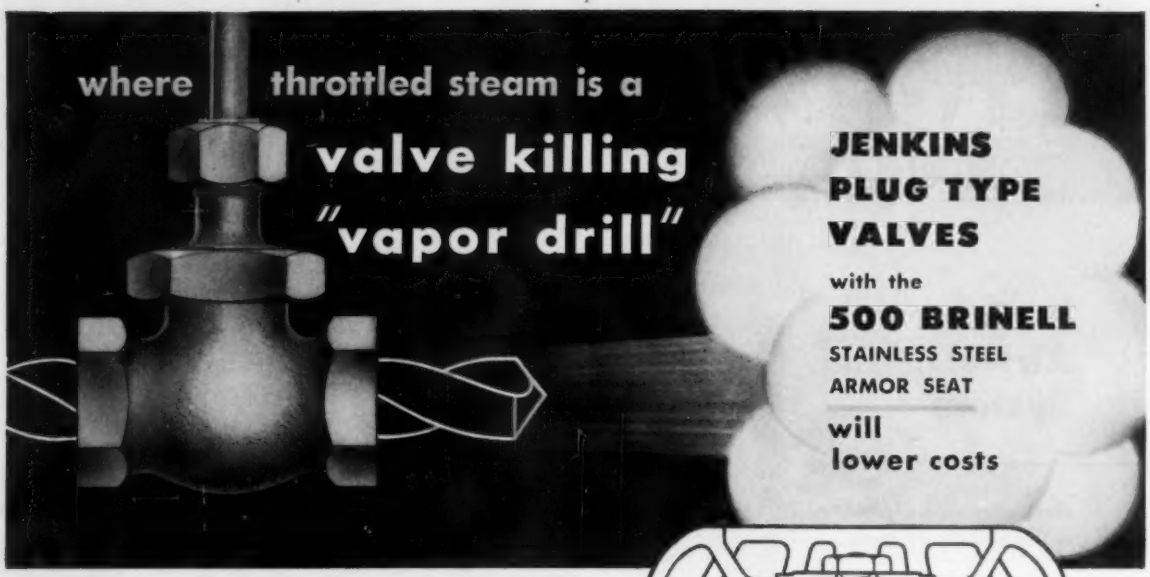
The B&G Thermoflo Balancer costs only a fraction as much as other devices which do not even have the built-in regulating valve and thermometer. And it's noiseless in operation.

BELL & GOSSETT

COMPANY

Dept. EC-5, Morton Grove, Ill.

Canadian Licensee: S. A. Armstrong Ltd., 1400 O'Connor Drive, West Toronto



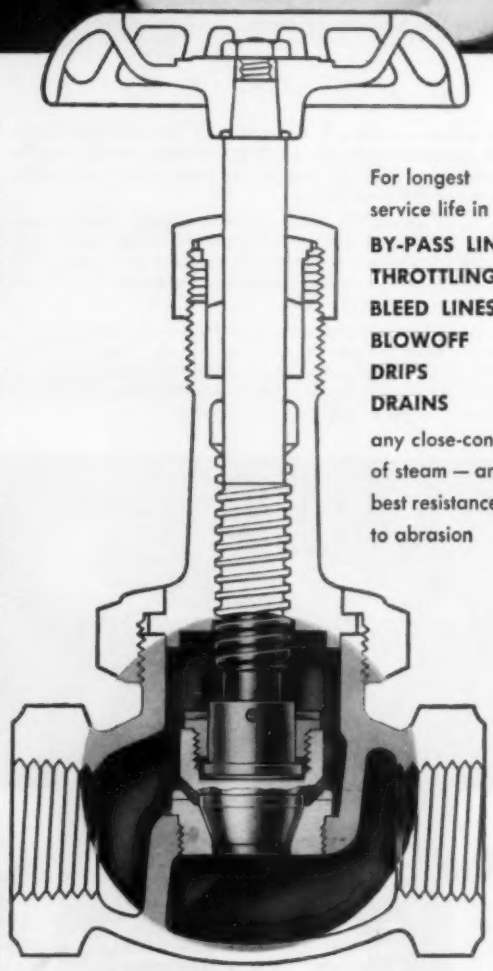
Closely regulated steam erodes grooves in seating units and drastically cuts service life of ordinary valves.

Jenkins Plug Type Valves have been engineered in every detail for maximum wear in such valve-killing service. The stainless steel Armor Seat defies the "vapor drill", and Jenkins quality throughout gives them top rating for wear-proof and trouble-proof perfomance.

Make you own test . . . in your toughest steam service . . . or anywhere that abrasion or erosion causes frequent valve failure. Compare, part for part, with any similar valve. You'll find that, again, Jenkins *extra value* pays off in longer life and lower maintenance cost.

Plug and seat ring are Jenkins JX500, a Stainless chromium alloy steel made to Jenkins high strength specifications, heat-treated to 500 Brinell. Seating surfaces are super-hard and mirror-smooth, offer highest resistance to galling, cutting, abrasion, and erosion. Wide, steep, 30° total taper permits extremely close regulation of flow and vapor-tight closure.

The Stainless steel plug is securely fastened to the spindle with a bronze locknut. Spindle is aluminum bronze with a tensile strength exceeding 70,000 lbs., — has high corrosion resistance.



For longest service life in
BY-PASS LINES
THROTTLING
BLEED LINES
BLOWOFF
DRIPS
DRAINS
any close-control of steam — and for best resistance to abrasion

300 lb. 200 lb. 150 lb.
GLOBE and ANGLE

For complete information call your Jenkins Distributor — ask for Form 202. Or write: Jenkins Bros., 100 Park Ave., New York 17.

SOLD THROUGH PLUMBING-HEATING AND INDUSTRIAL DISTRIBUTORS

JENKINS VALVES
LOOK FOR THE JENKINS DIAMOND
SINCE 1864 TRADE JENKINS MARK
Jenkins Bros.

EQUIPMENT DEVELOPMENTS . . .

For reviews of Recent Trade Literature see Page 248

Packaged Conditioner . . .

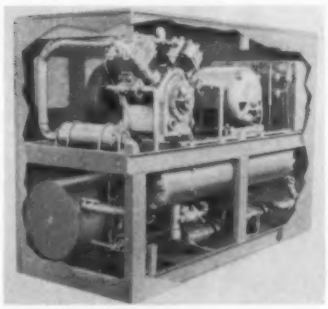
. . .for central or in-the-space air conditioning of stores, offices, other areas—Carrier Corp., Syracuse 1. "Weathermaker" designed to offer greater versatility in supply and return duct connection, reduce space required, permit freedom in location whether used singly or as part of multiple packaged installation. Matching plenum and return air base can be used instead of ductwork. Return air may be brought in at bottom of unit, or at front, rear or sides. Is said to have simplified wiring connections, require less refrigerant. Features "multi-bank" cooling coil design said to improve efficiency, prevent re-evaporation of condensed moisture. Employs water cooled refrigeration. In 2, 3, 5 hp models. Matching heating coils may be added inside unit without alteration.

Expansion Connector . . .

. . .engineered to compensate for expansion, contraction in steam, hot water lines—Packless Metal Hose, Inc., New Rochelle, N.Y. "Flexline" is all brass constructed, seamless flexible metal hose with high tensile bronze braid, male fittings. Standard sizes ¼ to 1¼ in. ID. Larger sizes available. Corrects misalignment, dampens noise, says company.

Room Air Conditioners . . .

. . .in three series, price ranges for 1956—Mitchell Mfg. Co., 2525 N. Clybourn Ave., Chicago. "Imperial" series in ¾, 1, 1½, 2 hp models, "Custom" in ¾, 1 hp models, "Deluxe" in ½, ¾, 1, 1½ hp models. "Imperial" 2 hp unit is said to be capable of cooling a five room house.

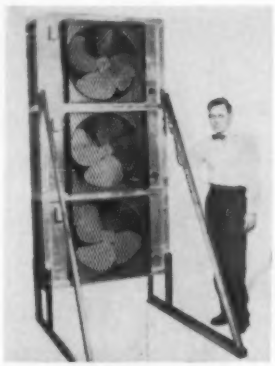


Liquid Chillers . . .

. . .with packaged design—Bell & Gossett Co., Morton Grove, Ill. In capacities 7½ to 50 tons, each unit ready for operation with basic connections. Shipped with charge of refrigerant, completely prewired panel box. Control system requires only power supply. All parts easily accessible, says company. For use in space cooling systems, combination heating and cooling systems, industrial processes requiring controlled cooling.

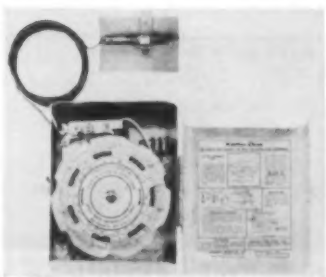
Oil Burner . . .

. . .designed to use No. 5 heavy oil—Rayfield-Staffco Burner Co., Inc., 2066 Canalport, Chicago 8. Dual piston, self lubricating air compressor maintain high pressure. Oil pumped at rate of 2 to 20 gph to compressor. Burner electrically controlled, preheats to provide trouble-free operation, says company. For protection, oil level cannot go below safe lubricating level. Recommended by company for large apartment dwellings.



Fan Condensers . . .

. . .for condensing refrigerants without using water—Bush Mfg. Co., 179 South St., West Hartford, Conn. For areas where water is too expensive, contains excessive impurities, poses disposal problem. Have company's "Inner-Fin" coil construction. Two basic models, "PFC-200" and "PFC-330," can be connected in field to provide wide capacity range. Headers swaged at one end to permit interconnection in multiple unit installations.



Time Switch . . .

. . .with weather actuated operation for programming heating systems—Automatic Devices Co., Inc., Western Springs, Ill. "Weather-Chron" is said to eliminate trying to outguess weather when setting switch. Outdoor temperature automatically resets time heating starts in morning, cutback at night for comfort temperatures when needed. Stops heat input when outdoor temperature reaches preselected minimum (such as 65 F), eliminates night setback

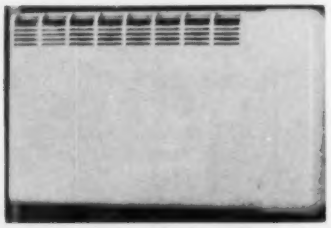
EQUIPMENT DEVELOPMENTS

Continued

when temperature drops below preselected low level (such as 10 F).

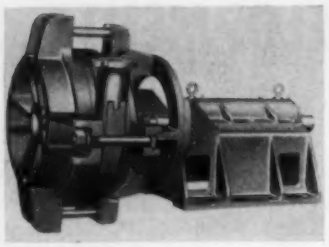
Air Conditioner . . .

. . .with gas operated design for year 'round heating, cooling—Servel, Inc., Evansville 20. Has 3 ton cooling capacity, 96,000 Btu output for heating. Still in experimental stage, 100 models have been placed with gas utility companies for field testing. Is one-half size of company's present 3 ton model. Requires no field assembly. Servicing requires access to only one side of unit. If tests confirm expectations, will be in production by mid-1956, company reports.



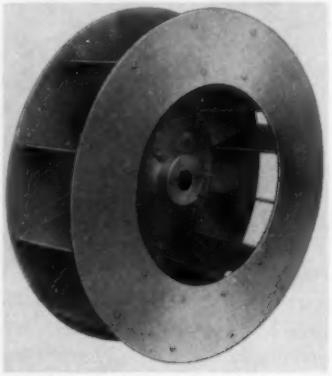
Finned Tube Radiation . . .

. . .wall hung for steam, hot water heating—John J. Nesbitt, Inc., State Rd. and Rhawn St., Philadelphia 36. Type " 'E' Sill-Line" brings company's line to five enclosure styles. Available with finned tubing either one or two rows high. In 2, 3, 3½, 4, 5, 6, 8 ft lengths. Back panel is single piece. Heating element hung from back panel. Over this is attached front panel which interlocks at top and bottom of back panel. Front panel is single piece formed to make complete cover.



Slurry Pump . . .

. . .designed to handle abrasive slurries of cement, sand, coal, solids, chemical sludges, other products up to maximum of fluid consistency under suction lift of positive head—Morris Machine Works, Baldwinsville, N. Y. Cited features: stuffing box subject to suction pressure only, wearing parts accessible without disturbing piping, rotating adjustable to take up for wear, liners on both sides of impeller renewable. In seven models 2 to 6 in.

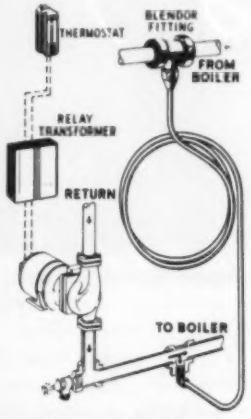


Fan Wheel . . .

. . .for applications where high velocity, low volume air required—Jan-Air, Inc., Richmond, Ill. Also for uses where foreign matter enters airstream. Passes such contaminants through wheel without clogging, says company. Cold rolled steel, stainless steel, or aluminum construction.

Natural Gas Powered . . .

. . .air cooled refrigeration condensing unit—Wood Electric Co., Inc., 471 Agee St., Camden, Ark. "Weatherbuster" uses internal combustion engine to drive reciprocating compressor and condenser fan. Slow speed design facilitates quiet, economical operation and long life, says company. Basically a refrigerant reclaiming unit, draws heat laden low pressure refrigerant vapor from cooling coil, compresses vapor, delivers it to condenser where vapor is liquified by rejecting latent heat to air passing over condenser. Liquid refrigerant drained to receiver, stored until needed again in cooling coil. Available in 3, 5, 7½ ton sizes. Larger 10, 15, 20, 25 ton evaporative condenser type units planned.



Boiler Water Control . . .

. . .designed for smooth, quiet blending of boiler and return water—Warren Webster & Co., 17th and Federal Sts., Camden 5, N.J. "Webster Blendor" now available for use with forced hot water heating. Fitting in supply main, with tube connected to return, includes thermostat which is said to hold back water from boiler, blend it gradually with cooler water from system. Heat builds up gradually, piping is warmed slowly. Noises caused by rapid expansion are eliminated, says company.

Fittings . . .

. . .of unplasticized polyvinyl chloride for instrumentation—Tube Turns Plastics, Inc., 224 E. Broadway, Louisville 1. For use with company's corrosion-resistant flexible tubing. Rec-

Make this Test

for Heat Flow in Buildings

Try this experiment. Take a piece of multiple accordion aluminum. *(We'll send you some free samples.)* Hold it very close to your cheek without touching. You'll be surprised! Notice how, in seconds, your cheek feels a glow of warmth. Why? Because the heat rays which are leaving your face (although without temperature), are being thrown back again at a 97% rate by this amazing insulation. Reflected to your cheek, the rays are now reabsorbed at a 90% rate and turned into heat.

THE BIG THIEF

The same thing happens in building spaces. This simple experiment illustrates an extremely important principle of heat flow. The greatest thief of fuel, of heat, and of comfort in buildings in winter, and of comfort and electricity for air-cooling in summer, is the flow of heat by Radiation.

Put multiple sheets of prefabricated accordion aluminum insulation inside wall and roof spaces, and you bar the path of this thief. For multiple accordion aluminum throws back, with 97% reflectivity, the heat rays that strike its surfaces. It also retards, most effectively, the flow of heat by Convection, Conduction, and Vapor Flow.

The tough aluminum sheets in multiple aluminum are almost completely impervious to water vapor, and are long and continuous. Infiltration under flat, stapled flanges is slight.

Where multiple aluminum is used, fortuitous vapor and water (for instance rain) which intrude into wall and similar spaces, will gradually flow out as vapor through exterior walls and roofs as pressure develops within, because vapor flows from areas of greater to less density. The vapor cannot back up through the continuous, almost completely impervious aluminum, so it flows *out* because exterior walls and roofs have substantial permeability compared to aluminum, far greater than the required 5 to 1 ratio.

For maximum uniform depth protection against heat loss and condensation formation, use **edge-to-edge** multiple aluminum,* **each** sheet of which automatically stretches from joist to joist.

*Patent applied for.

How thermal losses can be reduced by successive sheets of metal and air layers is described in the booklet, "Insulating Effect of Successive Air Spaces Bounded by Bright Metallic Surfaces" published by the American Society of Heating and Air-Conditioning Engineers. This report is well worth reading. Obtain it free—Send the coupon.

COST OF EDGE-TO-EDGE INFRA
Multiple Aluminum Insulation installed in new construction between wood joists, material and labor
Type 6-PS about 10¢ sq. ft. Type 4-PS about 8¢ sq. ft.

Infra Insulation Inc., 525 Bway., N.Y.C. Dept. H-11

Please send ☐ ASHAE booklet, "Insulating Effect."

NAME_____

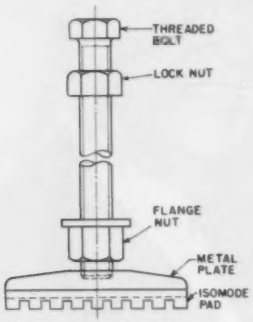
FIRM_____

ADDRESS_____

EQUIPMENT DEVELOPMENTS

Continued

ommended by manufacturer for instrumentation of chemical plants, hospitals, laboratories; food, drug, beverage processing industries. Assemblies can be put together using knife or scissors. Fittings, tube furnished in 1/4, 3/8 in. sizes. Include half unions, unions and bulkhead unions, connectors, caps. Maximum working pressure is 150 psi at 75 F.



ISOMODE LEVELING MOUNT

Leveling Mount . . .

. . . with "double-function" design —MB Mfg. Co., Div. of Textron-American, Inc., 1060 State St., New Haven 11, Conn. Is said to permit quick, easy leveling without lagging to floor of machinery. Also reduces transmission of machine noise, shock, vibration. Consists of metal plate with Isomode pad cemented to it, threaded bolt, flanged leveling nut, lock nut. For load ranges 100 to 12,000 lb.

Level Controller . . .

. . . combining advantages of electronic and pressure control instruments—Fielden Instrument Div., Robertshaw-Fulton Controls Co., 2920 N. Fourth St., Philadelphia. "Pneutronic" uses electronic capacitance sensing elements to detect minute changes in tanks, drums, process baths, pipe lines, other conveyors. Signals then converted into proportional pneumatic output. Recommended by company for petroleum, chemical, food processing, other industries. Available in dustproof, explosionproof cases for use in hazardous locations.

Flow Meter . . .

. . . designed to measure either mass or volume flow regardless of its electrical conductivity, accompanying variables—Fischer & Porter Co., Hatboro 35, Pa. Uses ultrasonic energy. Pressure drop is virtually zero, says company. Volume flow rate measured by two transducers, each transmitting and receiving controlled pulses of ultrasonic energy across pipe section —one diagonally upstream, other diagonally downstream. Capacities to 12,000 lb per min with 2.5 to 1 fluid density range. For standard pipe sizes down to 2 in., temperatures −50 to 225 F, pressures 150 and 300 psi standard.

Sound Level Meter . . .

. . . with separate output stage for driving sound analyzers, peak noise indicators, graphic level recorders, other accessory equipment—Herman Hosmer Scott, Inc., 385 Putnam Ave., Cambridge 39, Mass. Removes necessity of switching off meter movement to avoid introducing distortion caused by rectifying action, says company. Has portable, compact design. Is engineered for measuring noise, sound, vibration equipment such as blowers, ventilating fans, industrial hygiene studies, acoustical surveys, etc.

Gas Unit Heaters . . .

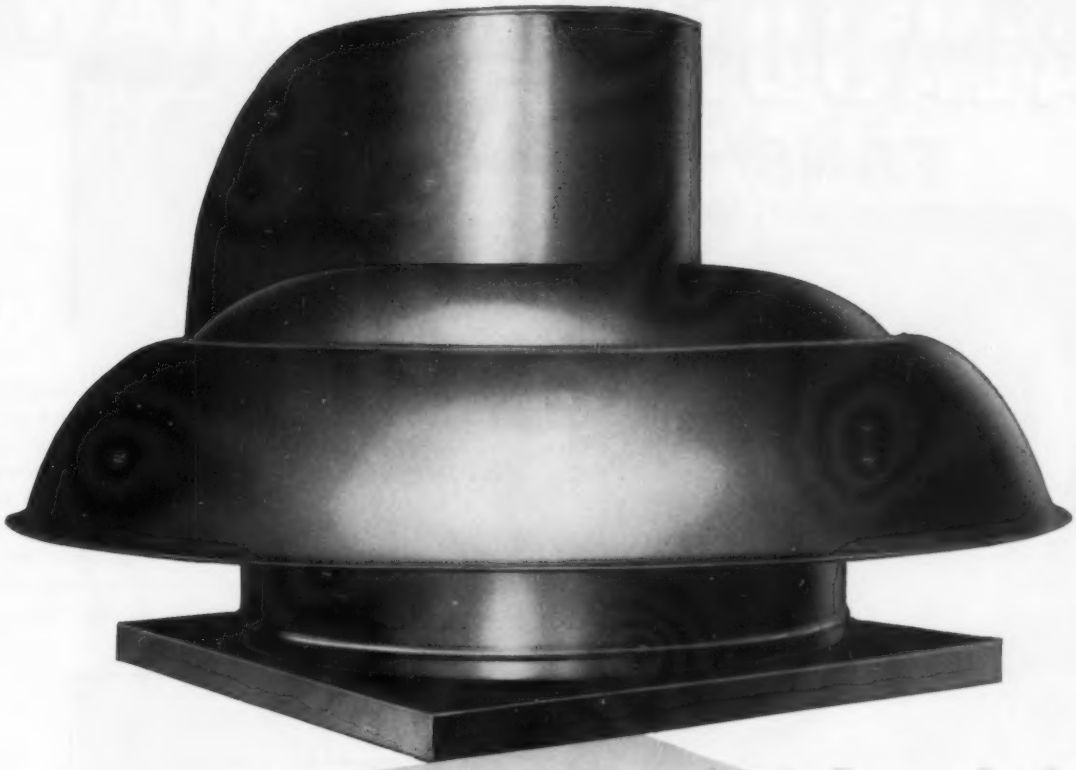
. . . added to company's heating equipment line—Temco, Inc., Nashville. Includes six different models ranging 50,000 to 225,000 Btu input. Units feature heat exchangers with high temperature porcelain enamel finish formulated to neither rust nor burn out. Heaters suspended from two pipe hangers with electrical, vent, gas line connection easily completed, says company.

Control Center . . .

. . . designed to scan, control up to 72 stations—Wheelco Instruments Div., Barber-Colman Co., Rockford, Ill. Engineered around use of company's flexible "Multronic Capacitrol," neon pilot lights, pulse actuated stepping switch, pulsing timer, small two tube non indicating controllers. Checks temperature at each of 72 control stations in less than 4 min, says company. Should any station be "off limits," visual and audible alarm given. Amount of correction needed at any point indicated by "Capacitrol," says company.

Humidity Controller . . .

. . . designed to operate large or small humidifiers, dehumidifiers, air conditioners to maintain control within ± 1.25 percent RH—American Instrument Co., Inc., Silver Spring, Md. "Humistat" is electronic successor to mechanical humidistats, says company. Relative humidity range of 5 to 95 percent covered by individual sensing elements with 15 percent RH ranges. Operating design eliminates need for recalibrations.



NEW CENTRIFUGAL ROOF VENTILATOR . . . QUIET RUNNING, LOW SILHOUETTE

For whisper-quiet operation on schools, hospitals, etc. Runs at low speeds, moves large volumes of air efficiently against static pressure. Low in silhouette, distinctively profiled, blends well with modern architecture.
Send for new 16-page catalog which also contains a section, "How to Select a Roof Ventilator."

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A DIVISION OF
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Division of American Machine and Metals, Inc.
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☐ Yes, please send me catalog on your new Centrifugal Roof Ventilator.

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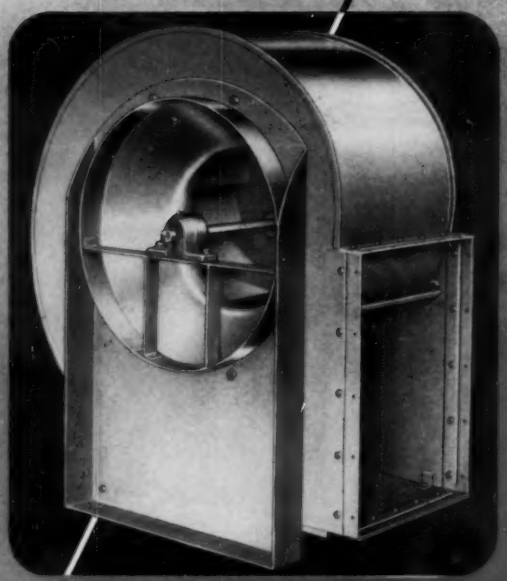
CITY ZONE STATE

ATTENTION MR.

ALADDIN FANS



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Certified ratings are the result of tests made by the Manufacturers in accordance with the Standard Test Code with the Standard Methods for the Determination of Performance of Fans and Blowers and the American Manufacturers and Testing Bureau.

AUTHORIZED BY N A F M

- RUGGED
- DEPENDABLE
- CERTIFIED RATINGS

You will find that ALADDIN Fans are available in many types . . . each ruggedly built and fully equal to the job for which it is intended. Thousands of ALADDIN Fans are now in service meeting the air-handling requirements of every essential industry, from chemical to aircraft, on farms and aboard ships.

More and more architects and engineers have come to know ALADDIN Fans . . . and to recognize their merits of quality and dependability.

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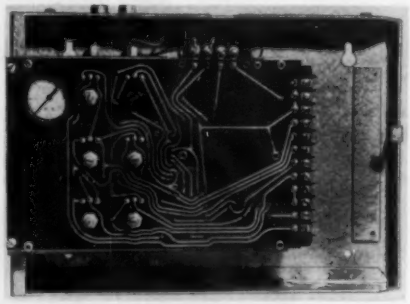
REPRESENTATIVES IN ALL PRINCIPAL CITIES IN THE WEST

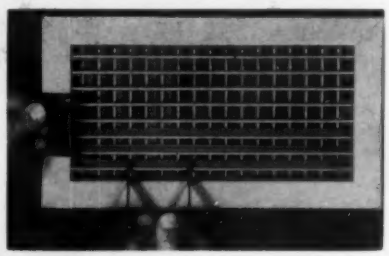
EQUIPMENT DEVELOPMENTS

Continued



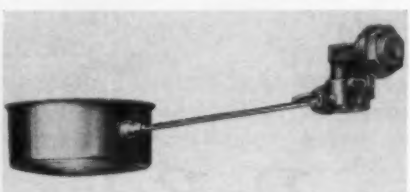
Electronic-Pneumatic Relay . . .

. . . designed to combine features of electronic temperature sensing with conventional pneumatic valve and motor operation—Minneapolis-Honeywell Regulator Co., Wayne and Windrim Aves., Philadelphia 44. Control used with 500 ohm electronic thermostat which can be mounted in place of existing pneumatic instruments. Relay consists of bridge assembly, amplifier, relay actuated valve unit. Bridge, amplifier assemblies mounted on hinged panel for access to valve unit, vacuum tubes.



Registers, Grilles . . .

. . . with blade type fabrication added to company's line —Register & Grille Mfg. Co., 70 Berry St., Brooklyn Ill. Recommended for schools, institutions, public buildings. Cited features: greater free air opening, deeper directional control blades, opposed action shutter with tamperproof key operation.



Miniature Float Valve . . .

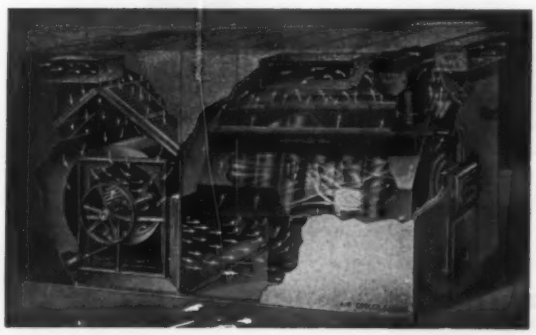
. . . for smaller water controlling requirements—Robert Mfg. Co., 9035 Venice Blvd., Los Angeles 34. Is said to accurately maintain liquid levels with positive shutoff. Capacity is 1 1/3 gpm at 50 psi. Recommended by company for cooling towers or evaporative air conditioning units for process and comfort applications, evaporative condensers, etc. Available with copper or styrofoam float.

WARM AIR HEATED... by Campbell

Church of Christ, Bloomfield, Iowa, comfortably heated since 1951, with a Campbell 8000 Series oil-fired heater. Architect, Hugo C. Haeuser; heating contractor, Nelson & Woode, Bloomfield.

IDEAL FOR CHURCH HEATING

Fast heat delivery plus positive, adjustable temperature control make Campbell 8000 Series Heaters especially adaptable for churches and other large public buildings. Campbell heaters are compact, easy to install, and operate very quietly. Available for all fuels in capacities up to 3,150,000 BTUs.



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We have a number of attractive openings for manufacturers' agents who call on heating contractors and architects. If interested, please state territory you cover.

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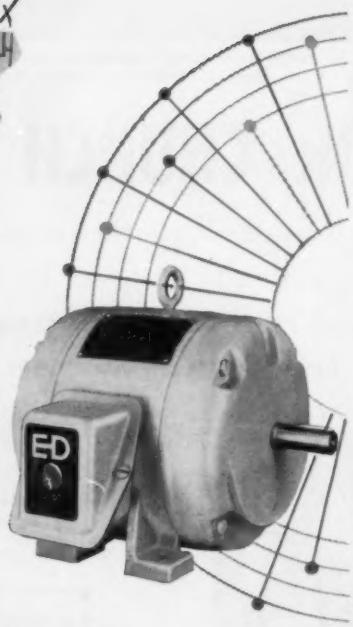
FOR INDUSTRIAL MACHINES

The mark of an Extra Dependable machine

From America's foremost producer of custom designed motors come these premium-built, *extra dependable* E.D. "power packages" for general industrial use—75 years in the making—yours today *at no extra cost!*

1 to 250 hp. AC and DC. N.E.M.A. standards.



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PRODUCT OF GENERAL DYNAMICS

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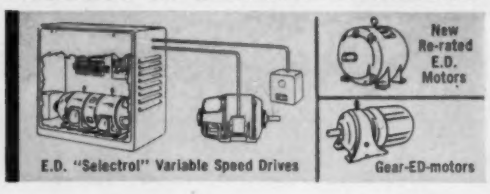
Write for Brochure 100 and literature on new E.D. motors and drives.

Electro Dynamic division of General Dynamics Corporation Bayonne, New Jersey



EQUIPMENT DEVELOPMENTS

Continued

Gas Regulators . . .

. . . with rugged construction designed to eliminate repairs—K-G Equipment Co., Inc., P.O. Box 538, Allentown, Pa. "On Guard" line has gage guard with positive spring lock action to protect against accidental breakage. Stainless steel nipple engineered to withstand impact of accidental cylinder upset. Newly designed stainless steel adjusting screw cuts down possibility of its becoming damaged. Regulators in single-, two-stage models for compressed gases. Recommended by company for construction, railroad, heavy industries fields.

Control Valve . . .

. . . with bellows sealed diaphragm—George W. Dahl Co., Inc., 430 High St., Bristol, R. I. Designed for positive, leakproof control of hazardous process flows in aircraft, marine, process industries. "Bantam" assembly "2038," shown, has special flange, air-to-close, Teflon seating with extra Teflon packing above bellows. Maximum diaphragm pressure rating is 100 psig. Bellows rating is 500 psig at −70 to 700 F.

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50th Anniversary

BRUNNER

SINCE 1906

DEPENDABLE

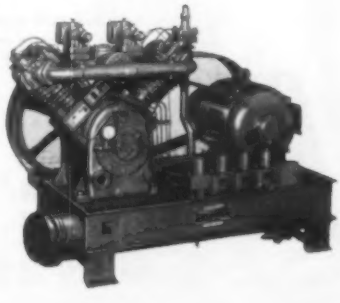
BRUNNER'S complete air conditioning line offers bigger profit opportunities

As we approach 1956 . . . our 50th Anniversary year . . . we pause only momentarily to salute the past.

Our idea of an Anniversary celebration is to make available to you the finest Air Conditioning Condensing Units in Brunner's history.

Look to Brunner in 1956 for the most complete air conditioning line . . . Condensing Units for remote installation . . . BAC package units for within-room or duct installation.

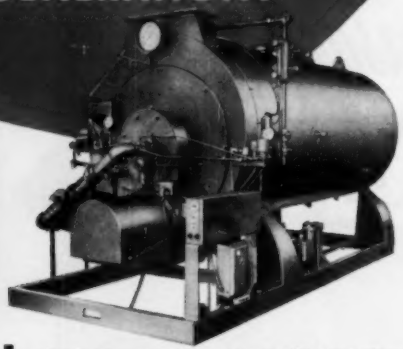
Brunner is your best 1956 buy for Bigger Profits!



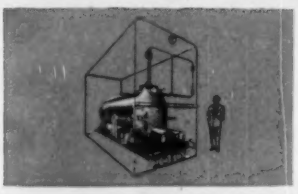
BRUNNER MANUFACTURING COMPANY, Utica, N.Y.
The Brunner Co., Gainesville, Ga.
In Canada:
Brunner Corp. (Canada) Ltd., Toronto, Ontario

CYCLOTHERM...

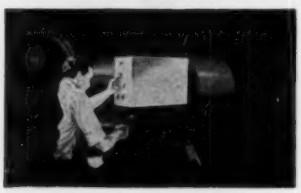
FEATURE for FEATURE THE MOST ADVANCED DESIGN in STEAM GENERATION!



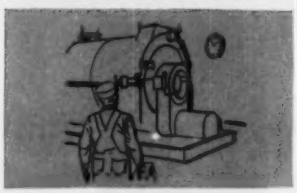
See Our Exhibit
Cyclotherm Booth 181
Chicago Exposition of POWER and MECHANICAL ENGINEERING
Chicago Coliseum
November 14 to 18, 1955



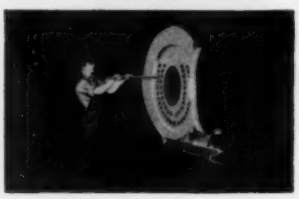
1. Most Compact For More Efficient Space Utilization! You can devote more space to storage and production. Or, you may need less space than you think. Cyclotherm requires minimum boiler room space. It has 40% less floor area and 75% less height than conventional units . . . is up to ⅓ smaller than other packaged units.



2. More Efficient Operation Reduces Fuel Costs! Cyclotherm guarantees a minimum 80% efficiency in oil and/or gas. Fuel changeover can be quickly made as fuel prices fluctuate. From cold start to full power takes only 15 to 20 minutes. Capacity can be reduced without losing peak efficiency.



3. The Finest Service Facilities In Steam Generation! *A nation-wide network* of factory-trained servicemen are available at any hour, weekdays and weekends.



4. Simplified Maintenance Saves Up To 50% In Costs! One maintenance man can clean return tubes . . . replace and clean burner nozzle. Firetube never needs cleaning.

Cyclotherm Steam and Hot Water Generators range from 18 to 500 hp . . . from 15 to 200 psi. For complete details on their many space- and cost-saving features, mail this coupon today for your free booklet.

YEARS AHEAD IN STEAM GENERATION
CYCLOTHERM®
Steam & Hot Water Generators

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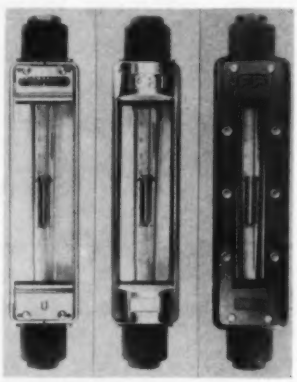
COMPANY .....
ADDRESS .....
CITY ..... ZONE ..... STATE .....

EQUIPMENT DEVELOPMENTS

Continued

Oiler . . .

. . . for flooding dies while threading pipe with hand die stocks—Ridge Tool Co., Elyria, Ohio. Portable design. "Ridgoilr" consists of removable 15 in. wide chip pan in oil reservoir with carrying bail from which screened hose connects with hand operated oil pump-gun. Device catches oil, chips, cutoffs. Allows endless oil stream on dies.



Flow Meters . . .

. . . with simplified design features, sturdy construction, greater visibility of metering tube—Fischer & Porter Co., Hatboro 35, Pa. "1700 Series Flowrator meter" retains features of established "700" series, including float, metering tube, universal end fittings. Have same dimensions to permit substitution without piping changes. Design uses one basic frame which, with change of covers, can be made into enclosed or pressure sealed meter. Built-in panel mounting fittings eliminate attaching mounting fixtures.

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Hot Water Heating Safety Valves and Controls

A.S.M.E. Rated Pressure Safety Valves

174
Series

Sizes ¾" to 2" inclusive

N74

Size ¾"

Feed Water Pressure Regulator

135HW

Sizes ½" to 2"

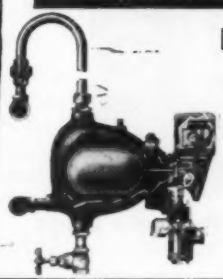
Dual Controls

45A

Sizes ½"

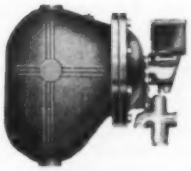
Steam Heating Boiler Water Level Controls

Boiler Water Feeders



60LWD ½" | 76LWD ¾"

Feeder cut-off combinations
Sq. Ft. Radiation
up to 5,000 | over 5,000



Low Water Cut-Offs

89A

½" Gauge Glass Type

93A

2½" Screw-in Type

Protective Devices for Hot Water Supply Systems

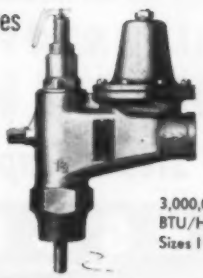
Fully Automatic
Temperature and Pressure Relief Valves

N40XL

500,000 BTU/HR
Size ¾"

140

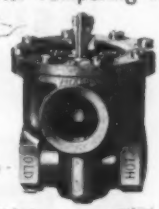
750,000 BTU/HR
Size 1"



340

3,000,000 BTU/HR
Sizes 1½" or 2"

Water Tempering Valve



71

Sizes ½", ¾", 1"

WATTS Regulator Company
LAWRENCE, MASSACHUSETTS

THE LARGEST, MOST COMPLETE LINE OF ITS KIND IN THE WORLD

THREE THINGS TO CONSIDER
in Selecting STEAM TRAPS

1. HOW MUCH CONDENSATE AT PEAK LOAD?

First determine how much condensate you'll have in the system at the peak load. When this is not known it can be easily figured by referring to the Anderson book "Solving Steam Trap Problems." However, to provide for a margin of safety the rating of the trap should be more than the condensate to be handled. The capacity rating factor should be at least two and sometimes as high as six, depending upon the steam condensing surface, the air to be vented as well as the type of trap used. By using Heat-Kwiks you never need a factor of more than 2 to 1. Therefore you get by with a smaller, less expensive unit.

2. HOW FAST MUST THE AIR BE VENTED?

It is desirable to heat up cookers, kettles, dryers, laundry and dry cleaning equipment, etc., quickly in order to increase production. Whenever this condition exists select Heat-Kwik Steam Trap. This trap vents air 8 times faster. The added production soon pays for the cost of the trap.

3. WHAT IS THE STEAM PRESSURE VARIATION?

When the pressure of a steam line drops off, the condensate-venting capacity of the conventional inverted bucket steam trap also falls off. Therefore if the pressure varies, choose a steam trap with a combination open float and bellows orifice . . . Heat-Kwik Steam Trap. The auxiliary bellows actuated orifice is unaffected by pressure.

Free!
36-page book "Solving Steam Trap Problems" shows how to select the right steam trap for any equipment. Write for your copy today.

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1949 West 96th Street, Cleveland 2, Ohio

SUPER-SILVERTOP
HEAT-KWIKS
the Engineered Steam Trap by
ANDERSON

EQUIPMENT DEVELOPMENTS
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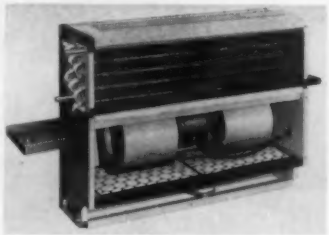
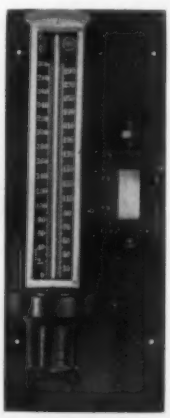


Air Conditioners . . .
. . . for concealed installations—Fedders-Quigan Corp., Heating Div., Lalor and Hancock Sts., Trenton 7, N.J. In three sizes for multiple room installations where hot, chilled water available as remote source. Recommended by company for new construction in apartment houses, office buildings, hotels, etc. Designed for heating, cooling, ventilating, circulating, filtering, dehumidifying. For housing within walls where space is at premium.



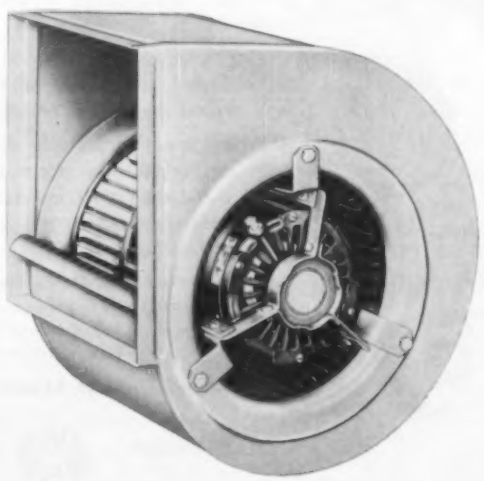
Absolute Pressure Gage . .
. . . designed for industrial, marine equipment employing minus pressures (turbine condensers, exhaust hoods, evaporators, etc.)—Precision Thermometer and Instrument Co., 1434 Brandywine St., Philadelphia 30. Requires no installation service other than mounting, connecting to line. Individually calibrated by comparison with standard mercury column vacuum gage whose readings are corrected for prevailing barometric pressure. In four scale ranges: 18 to 30 in. vacuum (in 1/10 in. divisions), 0 to 12 in. absolute, 0 to 6 psi absolute, 0 to 300 mm absolute.

KEEP IT QUIET

Just between us — there's a secret in Utility's new Direct Drive Blower that gives you practically no-sound operation. These blowers are now equipped with neoprene hubs which isolate motor noise and vibration. A simple technique developed by Utility's fine engineering minds — it is included in all direct drive blowers at no advance in cost. The first to utilize this exceptional innovation, Utility is a leader in the kind of high speed production which permits quality performance at a quantity price.

Let your customers in on it — Utility's Direct Drive Blowers keep it quiet and offer many other exclusive features. They are adaptable to the manufacture of heating, cooling, refrigerating and ventilating equipment . . . require less space, have no unnecessary accessories and can be speed-controlled easily. Check Utility for blowers, blower parts or any combination of parts — and discover for yourself . . .

YOU CAN'T MATCH UTILITY FOR PRODUCT AND PRICE



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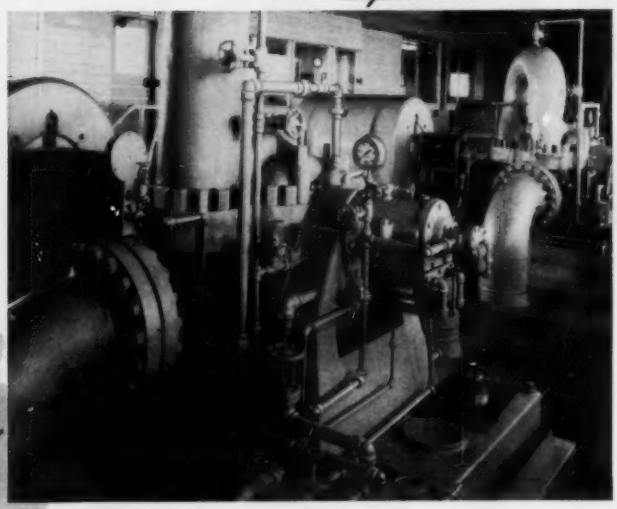
UTILITY

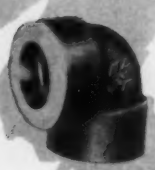
Producers of blowers and blower parts for original equipment manufacturers. Manufacturers of heavy and standard duty blowers for heating, air conditioning and ventilating installations. Write for catalogue data.

WATSON-STILLMAN

FORGED STEEL FITTINGS



WORK BEST...under pressure



In high pressure steam lines... process liquid and gas piping... hydraulic fluid lines... wherever strong, tough pipe joints are needed, Watson Stillman Forged Steel Fittings provide a safety factor against costly piping failures. They resist pressure, heat, corrosion, shock and vibration because they're drop-forged of high quality steel to produce a dense, tough, forged-fiber structure that can really take it.

Extra strength is built into W-S fittings in other ways too... such as the heavy reinforcing bands extending well beyond the threads or sockets.

Protect your high pressure piping system with Watson-Stillman Forged Steel Fittings. Available in carbon, stainless and alloy steels, in Screw-End and Socket-Welding Types to meet your service requirements. Send today for Free Catalogs.

Bulletin A3-50—Forged Steel Fittings
Bulletin S-1-55—Stainless and Alloy Fittings
Bulletin U-1—Forged Steel Unions
Bulletin S-3-55—150 lb. Stainless Fittings

Sold Through Leading Distributors

WATSON-STILLMAN FITTINGS DIVISION

H. K. PORTER COMPANY, INC.
Roselle, New Jersey

EQUIPMENT DEVELOPMENTS

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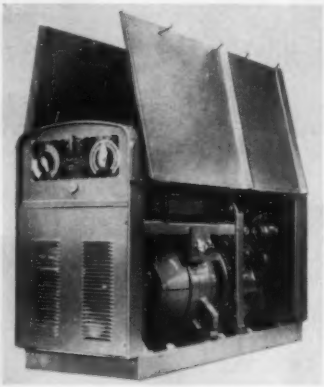
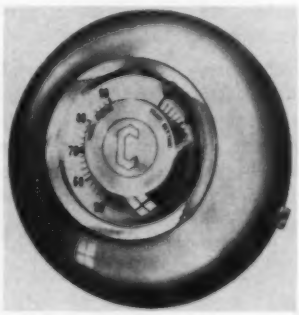


Diesel Driven Welder . . .

. . . for construction, pipe line, structural welding—Lincoln Electric Co., 22801 St. Clair Ave., Cleveland 17. "Shield-Arc SAE-250" rated 250 amps at 40 volts, 60 percent continuous duty cycle. Is an addition to company's line of dual continuous control welders designed to provide regulation of voltage, amperage throughout entire output range. Ranges 50 to 250 amps, handling $\frac{1}{16}$ to $\frac{1}{4}$ in. electrodes. Powered by 39 hp, 1700 rpm diesel engine. Has 12 volt starting motor, ether injection system for cold weather starting.



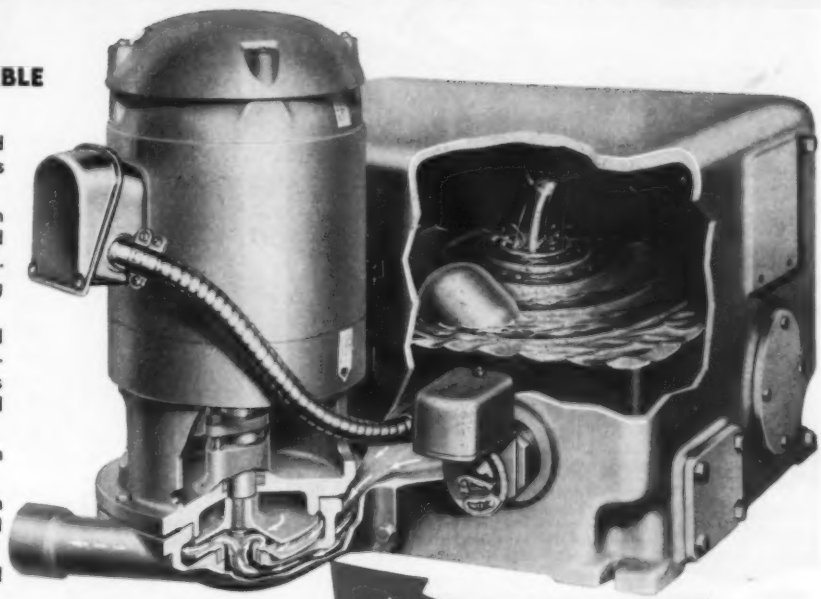
Round Thermostat . . .

. . . with improved features, advantages—Crise Controls Div., Arco Mfg. Co., Columbus 16, Ohio. Enclosed snap action switch makes or breaks circuit. Separate scales provided for room temperature and temperature setting. Adjustment lever designed to permit positive settings. Adjustable heater covers 0.35 to 1.2 amp range. In two models: "TR-125" for low voltage circuits, "TR-125 M" for millivolt circuits.

HOFFMAN NEW AND IMPROVED CLOSE-COUPLED CONDENSATION PUMPS

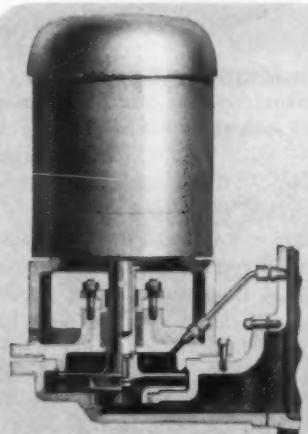
DESIGN FEATURES THAT ASSURE YOU THE MOST MODERN PUMP AVAILABLE

1. Bronze fitted throughout.
2. Enclosed, precision balanced bronze impeller that handles hot water effectively.
3. Stainless steel shaft extension accurately turned and ground with impeller securely locked.
4. Handy drain plug for draining impeller casing.
5. Ball bearing motor made and guaranteed by leading manufacturer 40° C. continuous duty, with ample overload capacity.
6. Heavy rust resisting cast iron receiver.
7. Heavy duty float control with seamless copper float and stainless steel rod.
8. No piping between pump and receiver.
9. Float switch is adjustable for various water levels in receiver.
10. Rigid motor support for quiet operation.



Type "HCS" Single Unit Hoffman Condensation Pump

WATER FLOWS DIRECTLY FROM CAST IRON RECEIVER INTO CENTRIFUGAL PUMP



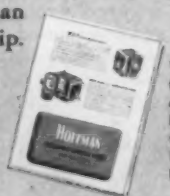
ENCLOSED, PRECISION BALANCED BRONZE IMPELLER ON STAINLESS STEEL SHAFT. PUMP UNIT IS BOLTED DIRECTLY TO WATER TANK.

SINGLE AND DUPLEX UNITS—RATINGS THROUGH 150,000 SQ. FT. E. D. R.

A Compact Pump Combining Dependable Performance with Low Power Cost

The full benefits of rapid condensate removal at low operating cost are yours with this highly efficient, dependable Type "HC" unit. These new, improved pumps are designed to operate at a wide range of pressures without over-loading the motor and are especially adapted for operation at the extremely high temperatures encountered in condensation pump service. All cast iron and bronze construction, they are so designed that parts subject to wear can be easily renewed. All together, these HC Pumps are a typical Hoffman product of sound design and excellent workmanship.

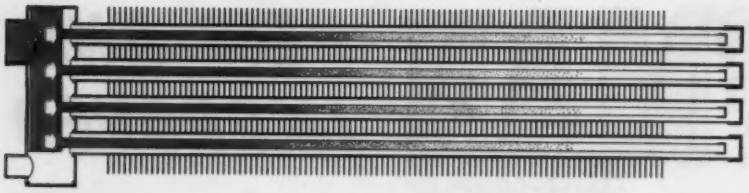
For small systems: "Watchman No. WC-8-20" Pump for low pressure heating systems. Ratings: up to 8000 sq. ft. E.D.R. Pump Capacity: 12 gallons per min. Pressure: 20 lbs. per sq. in. at pump discharge. ⅓ HP standard NEMA motor.



Write today for your copy of this new Hoffman Condensation Pump Catalog.

HOFFMAN SPECIALTY MFG. CORP. • 1700 West 10th Street, Indianapolis 7, Indiana

Makers of Valves, Traps, Hot Water Heating Systems, Vacuum and Condensation Pumps . . . Sold by Leading Wholesalers of Heating and Plumbing Equipment



Conventional
Steam is apportioned among all the tubes

Conventional steam-distributing tube surface: Steam flow is divided among *all tubes* in the coil. With low flow, surface is only partially filled with steam. Air near the supply is *heated*; near the return, air is *unheated*. Temperature stratification occurs. Condensate may be exposed to *freezing*.

First again!

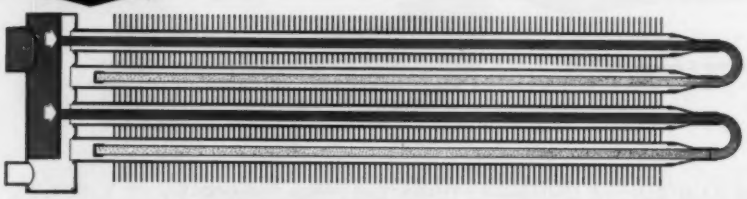
A NEW HEATING SURFACE

SERIES T WITH *Trombone*

STEAM-DISTRIBUTING TUBES

Nesbitt Trombone
Steam is apportioned to every other tube

Nesbitt Trombone steam-distributing tube surface: Steam flow is divided among *half the tubes*—the same steam quantity goes *twice as far* in each tube. Even small quantities are distributed over the entire surface area. Results: *uniform* final temperatures for the full length of the coil; positive freeze protection; unequalled performance with modulated control.



ELIMINATES STRATIFICATION AND ALL DANGER OF FREEZING UNDER MODULATED CONTROL

HERE'S an entirely new principle of steam-distribution for heating surface which provides *uniform final temperatures* and *positive freeze protection* over the *entire capacity range* — from 100 per cent down to shut-off.

Each "trombone" steam-distributing tube serves *two adjacent condensing tubes* from a single supply-header connection. Steam must travel across the first leg of the trombone tube (and thus, the full length of the surface) before reversing, under increased demand, to serve the second leg.

Nesbitt Series T Surface is unmatched for heating and ventilating applications with modulating valve control, and for preheating purposes.

Get the full story on Nesbitt Series T Surface. Send for Publication 305.

Nesbitt HEATING AND COOLING SURFACE

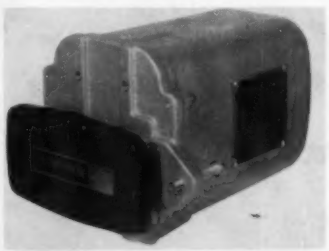
MADE AND SOLD BY JOHN J. NESBITT, INC., PHILADELPHIA 36, PA.

EQUIPMENT DEVELOPMENTS

Continued

Air Conditioner . . .

. . .for stores, small business buildings, homes—Worthington Corp., Harrison, N.J. "Flexi-Cool" available in 2, 3, 5, 7½ hp sizes. Cooling cycle section alone may be added to an existing furnace. "Flexi-Cool" section assembled as unit can also be installed remotely with ductwork extended to conditioning area. May be connected to air cooled condenser for where water is scarce. Adaptable to practically all types of limited space installations, says company.



Pneumatic Integrator . . .

. . .requiring no cams for square root extraction—Foxboro Co., Foxboro, Mass. Provides continuous integration of industrial process flows to within ½ percent accuracy. In operation, receives 3 to 15 psi measurement signal from differential pressure transmitter. Signal, applied through bellows, positions force bar in relation to nozzle. Resulting back pressure at nozzle, amplified by air relay, regulates jet of air into blades of turbine wheel. As wheel revolves, weight, pivoted on wheel, produces centrifugal force. This is fed back to bar to balance measurement signal. Revolving turbine wheel geared to counter which totalizes flow.

LEADERS RELY ON LAU

FOR SUPERIOR COMPONENTS IN AIR-HANDLING EQUIPMENT

Series "A" and Lau-Pak Gold Seal Bearings

Self-Aligning Pillow Blocks

Lausteel Variable Speed and Constant Speed Pulleys

SEE US AT BOOTH 233

Air Conditioning and Refrigeration Industry 9th Exposition at Atlantic City

Quality engineering and advanced design are characteristics of every **Lau** component for air-handling equipment. **Examples:** the five units illustrated here. No matter how large or how small, how intricate or how simple, if you buy it from **Lau** you know it will live up to every claim made for it. That's why leaders in air conditioning, heating, ventilating, oil burning, refrigeration, and automotive accessory equipment manufacturing rely on **Lau** for standard and special items.

LAU SERIES "A" BEARINGS • LAU-PAK GOLD SEAL BEARINGS

Series "A": self-aligning, self-oiling bronze bearing held in the housing under uniform spring pressure. Large capacity oil reservoir. Bore sizes: ⅝", ¾", 1", and 1 3/16". **Gold Seal:** requires **no additional lubrication;** ample supply of plastic petroleum sealed in housing. Bore sizes as above.

LAU SELF-ALIGNING PILLOW BLOCKS

Lightweight, low-cost, oil-tight steel housings with porous bronze bearings. Hold **much** more oil than cast iron types. Long bolt slots permit interchanging with other makes. Bore sizes: ⅝", ¾", 15/16", 1", and 1 3/16".

LAUSTEEL VARIABLE SPEED AND CONSTANT SPEED PULLEYS

Variable Speed: allow speed variations up to 30%, thus assuring noise-free, efficient operation for many drive combinations. Diameter: 3¼" OD. Bore sizes: ½", ⅝", and ¾". **Constant Speed:** for use with both "A" and "O" section belts. Give better performance with less friction, longer belt life. Diameters of 6" to 10" inclusive.

LB-5-55

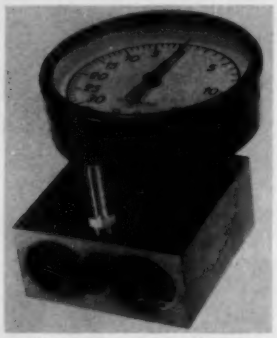
THE LAU BLOWER COMPANY • 2112 Home Avenue, Dayton 7, Ohio

In Canada • The Lau Blower Company of Canada, Ltd., Kitchener, Ont., Canada

LAU World's Largest Manufacturer of Air Conditioning Blowers

EQUIPMENT DEVELOPMENTS

Continued

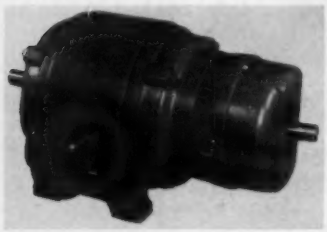


Transformer Breather . . .

. . . valve for control of temperature induced pressure changes in oil filled power transformers—James-Pond-Clark, 2181 Foothill Blvd., Pasadena 8, Calif. Designed to meet requirements of ASA. Made of solid brass bar stock, can be mounted externally without added protection. Uses standard gage connection. Requires no additional piping. Incorporates manually operated sampling valve with hose barb connection.

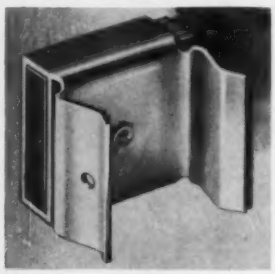
Spray-On Protection . . .

. . . for insulation—Eagle Picher Co., 900 American Bldg., Cincinnati 1. "Spray-Mastic" is protective, asphaltic coating compound of chemical dispersion type. Applied with conventional spraying equipment. Sprayability virtually unaffected by temperature between 40 and 140 deg variation, says company. One gallon provides coating for 20 sq ft.



Brake Motor . . .

. . . built to rerated NEMA specifications—U.S. Electrical Motors, Inc., Box 2058 Terminal Annex, Los Angeles 54. Designed for quick stops, positive holding. Features through shaft extension for hand cranks, tachometers, other accessories. Direct acting magnetic disc brake can be connected directly to motor terminals or to separate power supply. Brake will set, hold if power fails or voltage low by means of mechanical spring action. In ratings 1 to 30 hp. With standard, undersize, oversize brakes.



Magnetized Clips . . .

. . . to hold portable gages to steel surfaces—F.W. Dwyer Mfg. Co., P.O. Box 373, Michigan City, Ind. Test proved to hold 15 lb. Will not shift or vibrate out of position, says company. Included as standard equipment on company's line of manometers.

REED

PORTABLE *Folding Tray* TRIPOD VISES

Patented folding tray locks legs solidly to end spring and recoil. Tripod folds compactly for convenient, one-hand carrying. Sets up or takes down easily.

Improved Chain Vise features a convenient side handle which ends fumbling or skinned knuckles. Capacity from ⅛" to 4" makes it ideal for construction or maintenance work.

Now available with a new and better Chain Vise or the long-jaw Yoke Vise

Reed Folding Tray Tripods are well known for their work-saving solidity and the ease with which they can be carried, set up or taken down.

The Chain Vise Model is easy and convenient to use because the handle is at the side where you can turn it easily and naturally. The chain drops into position even on 4" pipe. You never have to hold it with one hand while you tighten with the other. Hardened vise jaws have three faces for triple life.

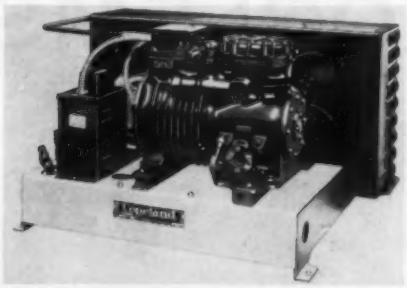
The Yoke Vise Model features the patented Reed long-bearing alloy steel jaws which provide a "wrench" action . . . so that a slight handle pressure holds any pipe from ⅛" to 2½". Reversible lower jaws. Special features to end lost motion.

Ask your jobber or write for free literature.

REED MANUFACTURING COMPANY

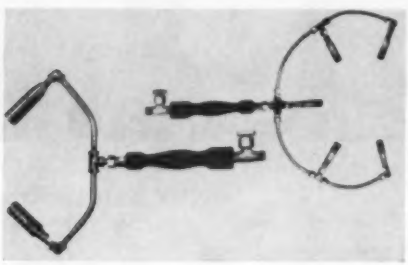
ERIE PENNSYLVANIA, U.S.A.

TRADEMARK



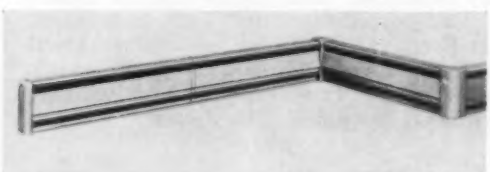
Air Cooled Condensing Units . . .

. . . with suction cooled motor compressors—Copeland Refrigeration Corp., Sidney, Ohio. In 2, 3, 5 hp sizes. Designed for air conditioning, other high suction pressure applications. Standard unit consists of suction cooled motor-compressor, oversized finned tube condenser, relay box, twin fans, receiver mounted on steel base. Assembly complete with refrigerant, electrical fittings.



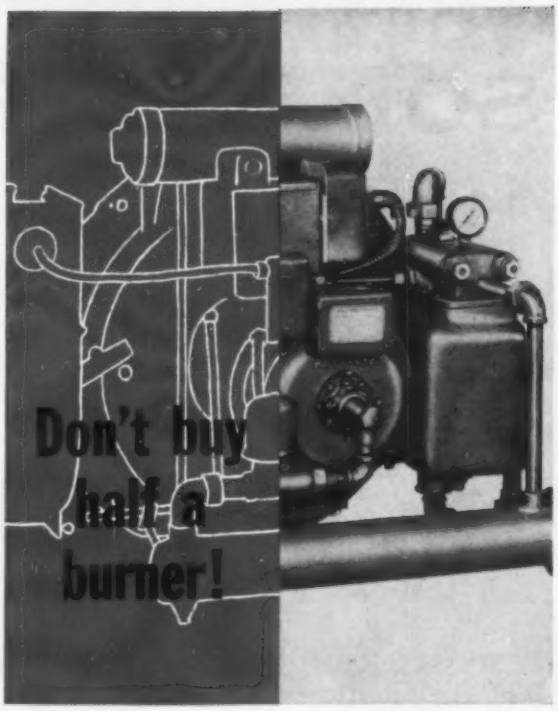
Circular Torches . . .

. . . designed for operation with LP gas—Mutual Liquid Gas and Equipment Co., 17129 S. Broadway, Gardena, Calif. Used for soldering large copper pipe. Distributes heat around entire joint in one operation. In two models, one has two broad flame tips, other has five pointed flame tips. Both are said to generate 2350 deg instantly. Operate on direct tank or regulated pressure. Handle copper pipe to 6 in.



Electric Baseboard . . .

. . . with increased capacities—Electromode Corp., 45 Crouch St., Rochester 3, N.Y. Now available in 900, 1200 watt capacity models in addition to 600. Each capacity made in models to operate on 120, 240 or 208 volts. Also, new outside corner piece available. Recommended by company for offices, institutions, homes. Systems controlled by wall mounted low or line voltage thermostats.



A shut down caused by lack of available service for your installation costs you plenty!

Yes, the loss of time and money in any burner shutdown can hurt you badly.

That's why there are *two* factors of prime importance in any commercial burner installation—a quality burner *and* readily accessible service. Only Ray—and the worldwide Ray dealer organization—gives you both.

No matter where you are, a Ray dealer is as close as your phone; there's no need to worry about prolonged shutdowns and consequent losses of time and money.

Ray dealers are highly skilled experts in all types of installations. For added insurance, the services of our own trained Ray engineers are also available to help you solve your particular problem.

When you buy a Ray you have the finest burner and the most comprehensive service—to provide you with a more efficient, trouble free, operation.

RAY OIL BURNER CO.

DISTRIBUTORS IN ALL PRINCIPAL CITIES OF THE WORLD

NOW G-E CEILING-MOUNTED PACKAGED AIR CONDITIONERS HELP YOU

SOLVE 2 PROBLEMS

1 SPACE

Now your scope of design can include the finest air conditioning without using a foot of vital floor space. Because new G-E Packaged Air Conditioners are fastened to the ceiling—or can be mounted on a shelf. And these trim units enhance any modern scheme. They're compact, self-contained—with no exterior parts. Motor, compressor and condenser are all sealed inside.

2 WATER

Where water restrictions present a serious problem, specify G-E ceiling-mounted units in air-cooled models available in 3 and 5 ton capacities. These models use no water—require only air and electricity. Water-cooled models also available in 3, 5 and 7½ ton capacities. For *year-round* comfort, all new G-E ceiling-mounted units may be equipped with coils for winter heating.

And, remember! G-E is the only complete packaged air conditioning line on the market. You can specify both floor- and ceiling-mounted models from a single manufacturer. For free booklet, "What Every Businessman Should Know About Weather Reflex", write General Electric Company, Commercial and Industrial Air Conditioning Department, Bloomfield, New Jersey.

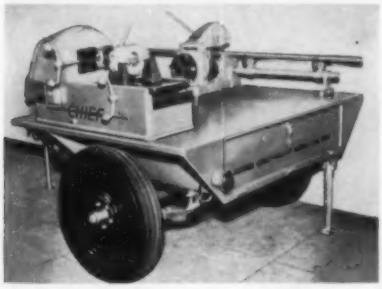
Packaged AIR CONDITIONERS

Progress Is Our Most Important Product

GENERAL ELECTRIC

EQUIPMENT DEVELOPMENTS

Continued

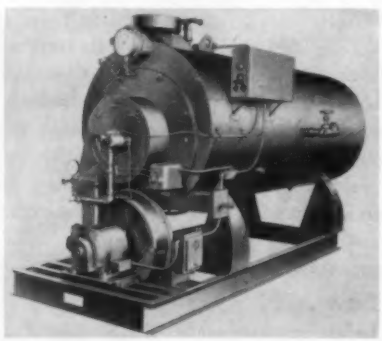


Mobile Trailer . . .

. . . for company's pipe and tubing cutter, and pipe, conduit and bolt threader—Gaines-Collins, 5474 Alhambra Ave., Los Angeles 32. Also accommodates portable generator, has room to store hand tools. Serves as work bench for cutting, threading in the field.

Power Operated Valve . . .

. . . designed for forward, reverse, neutral action—Ledeen Mfg. Co., 1600 S. San Pedro St., Los Angeles 15. Model "PON" is four-way disc type for air, gas, oil, water service. Operated by three-position power attachment operated by air or gas. Has rotating disc construction, molybdenum alloyed semi-steel body with chromium plated surface.



Steam Generators . . .

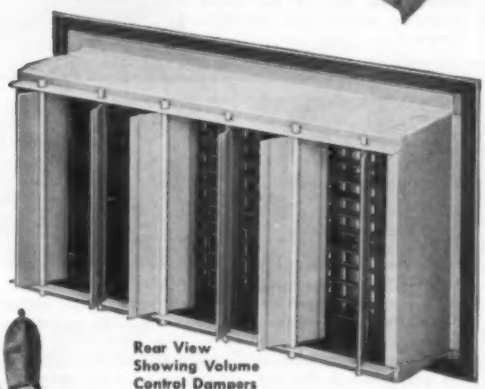
. . . incorporated with secondary air dampers in blower housings—Cyclotherm Div., National-U.S. Radiator Corp., Oswego, N.Y. Is new feature of all of company's 18 to 500 hp boilers. Damper is said to make it simpler, easier to adjust secondary air requirements. Also gives greater degree of accuracy in adjustment, says company.

INDEPENDENT

"Fabrikated"

DOUBLE CORE REGISTERS
with opposed blade dampers
key control
For Commercial Installations

No. 27
Adjustable Vertical Front Bars
Adjustable Horizontal Rear Bars



Rear View
Showing Volume
Control Dampers

Write for Bulletin
No. 54-A which gives
complete details and sizes
up to 48" x 24"

Always Leading—
Always Progressing

THE INDEPENDENT
REGISTER CO.
3747 E. 93rd STREET · CLEVELAND, OHIO

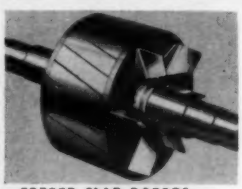
To AIR CONDITIONING ENGINEERS,
Howell suggests

What to look for in the New Rerated Open Motors

Besides the compactness, lighter weight to handle and ship, and the lower cost in many h.p. ratings that the rerated motors give you, why not look for evidences of *all-around* modernization in motor design? New ventilation principles, real streamlining, and better bearing protection, for instance. Compare the Howell Series 100 motors — a few details on the open drip-proof construction are shown below — and you'll *have* what you're looking for!

VENTILATION . . . "Cool running" means long life in motors. The steel shell of a Howell motor and a new stator design with the largest air passages yet devised put ample ventilation where it's needed. Compare!

BEARINGS . . . They should be fully protected. Dirt can't enter Howell's double shielded bearings either from inside or outside the motor, because they are sealed in the end plate cavities by dust-tight inner caps. Compare!



COPPER-CLAD ROTORS . . . Howell motors have copper-clad rotors. This means better heat conductivity, stability at high temperatures and, as opposed to die-cast rotors, greater design flexibility to meet your special requirements. Compare!

* *In addition to the open-drip type shown here, Howell Series 100 motors are made in splash-proof, weather-protected and TEFC enclosures: also as the power units of Howell gearmotors and brake motors.*

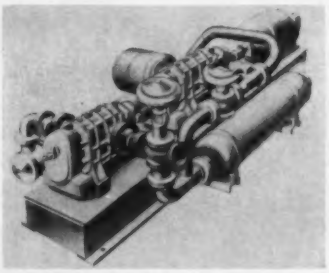
WRITE FOR BULLETIN H-100-R

Precision-Built Motors for Industry Since 1915

HOWELL MOTORS

EQUIPMENT DEVELOPMENTS

Continued



Two-Stage Compressor . . .

. . . for where high pressure, high capacity compression of air, other gases required—Read Standard Corp., 370 Lexington Ave., New York 17. "Standardaire" available in models 15 to 600 hp with capacities 100 to 4000 cfm. Includes pair of positive displacement, axial flow blowers arranged to work in two stages to boost discharge pressure in normal range of 15 to 50 psig. With appropriate inlet pressures, discharge pressures to 125 psig are possible, says company. For gas service, compressor is equipped with mechanical seals; for air, with labyrinth seals.

Welders . . .

. . . in 500, 750, 1200 amp models for constant voltage—Harnischfeger Corp., Milwaukee 46. Operator selects the arc voltage he desires. Voltage remains constant during entire welding cycle, says company. Is said to effect lower installation wiring costs, savings in power. For such welding processes as submerged arc, inert gas (MIG) semi-automatic, hard surfacing, automatic stud welding, low current density welding.

Power Saw . . .

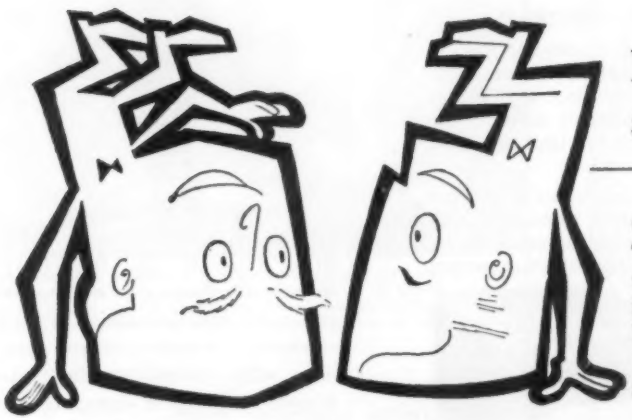
. . . with design improvements—R.C.S. Tool Corp., 220 N. Broadway, Joliet, Ill. "Super Saw" has direct drive coupling feature engineered to insure connection between saw and drill chuck. User can remove saw from drill, use drill for other services. Incorporated with latest developments in bearings, drive, cooling mechanism, says company. Parts interchangeable with company's saws now in service.

Our coal bills are lower than they used to be. Are we getting cheaper coal?

No. The coal may be higher priced, but it just costs less.

Man, you've gone crazy! Telling me high-priced coal costs less.

That's exactly what I mean. This coal has less moisture and less ash. That leaves more usable coal in every ton. It burns better in our type of boiler. Add it up, and we're getting the same amount of steam with a lot less coal.



How did you find out about this coal?

I asked the Chesapeake and Ohio coal people to recommend a coal that would give less smoke. The coal they suggested not only burns practically smokelessly, but as you see for yourself, it costs less. I used to buy coal strictly on price, but I know better now. Picking the right coal for any particular set of conditions is a job for an expert.

P.S.

There's a lot more to buying coal than the cost per ton. Why not contact coal producers on the C&O to solve your particular fuel requirements, or write to: R. C. Riedinger, General Coal Traffic Manager, Chesapeake and Ohio Railway Company, Terminal Tower, Cleveland 1, Ohio.

Chesapeake and Ohio Railway

WORLD'S LARGEST CARRIER OF BITUMINOUS COAL

BARBER COLMAN

Wheelco Instrument Service

"Custom-designed" combustion safeguard systems for just about any heating problem you can name!

Wheelco instrument engineers solved this combustion safeguard problem by choosing correct components from the most complete line of instruments and accessories available. System comprises 80 No. 1470 Conductivity Rectifier Flame-otrol units for use on electrically ignited main burners, with automatic limits on pushbutton trial for ignition. These chassis are the plug-in type with cabinet mounted terminals.

Wheelco maintains a nation-wide sales and service organization to offer you engineering assistance in solving any of your heating problems. Don't hesitate to call on your Wheelco field engineer to take advantage of his wide experience in designing and specifying combustion safeguard systems.

New FLAME-OTROL

Manual and automatic models bring you many improvements, including "plug-in" chassis, new safety-type terminal strip, "safe-start" operation, and convenient external test points to simplify circuit and voltage checking. Available with all conventional industrial-type sensing systems for improved flame supervision with gas, oil, or combination gas-oil firing. Bulletin F-6570.

WHEELCO INSTRUMENTS DIVISION

Barber-Colman Company

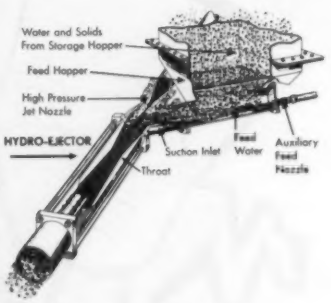
DEPT. W, 1501 ROCK STREET, ROCKFORD, ILLINOIS

BARBER-COLMAN OF CANADA, LTD., DEPT. W, TORONTO & MONTREAL, CANADA

Industrial Instruments • Automatic Controls • Air Distribution Products • Aircraft Controls • Small Motors Overdoors and Operators • Molded Products • Metal Cutting Tools • Machine Tools • Textile Machinery

EQUIPMENT DEVELOPMENTS

Continued



Jet Pumps . . .

. . . designed to transport solids through pipe lines—Allen-Sherman-Hoff Co., Wynnewood, Pa. "Hydro-Ejector" in sizes for 4, 6, 8, 10 in. pipe lines. Jet nozzle tip located out of path of materials being handled so not to interfere with free flow of solids. Unit installed with water tight housing, observation window, emergency flow connection which encloses feed hopper and discharge opening of storage hopper. Can be equipped with special gaskets to withstand effects of acids, alkalis, high temperatures.

Gas Shutoff Valve . . .

. . . with wrench flat feature—Madden Brass Products Co., 948 Oliver, Aurora, Ill. Feature is said to permit quick, easy installation. Permits servicemen to make positive connections with normal wrench torque without distorting or damaging valve plug or body.

Armored Purge Meter . . .

. . . with all metal construction, 1500 psi ASA pressure rating—Fischer & Porter Co., Hatboro 35, Pa. For use in chemical or processing installations where purging required. Uses magnet and follower to indicate flow rate.

BARBER COLMAN

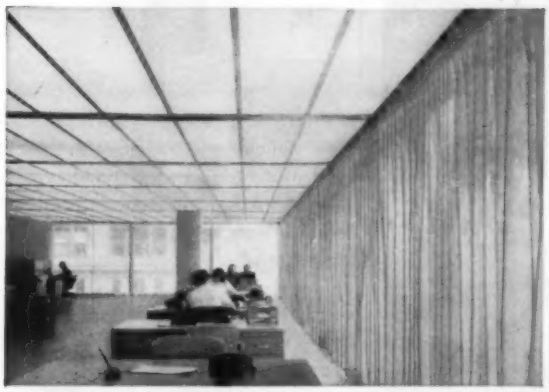
uni-flo Engineered Air Distribution

High velocity air distribution one of advanced features in Manhattan "glass-box" bank

Photos by Ezra Stoller

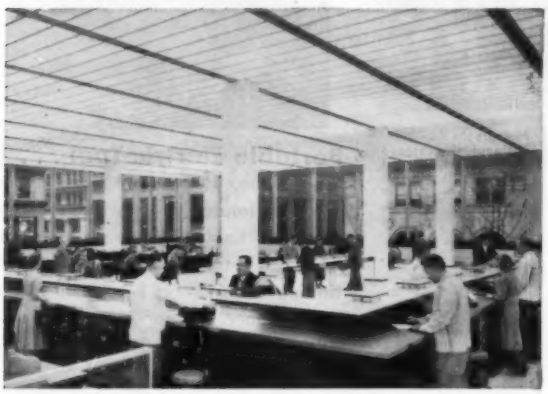
"A showcase for banking" is a vivid picture phrase describing this unusual new Fifth Avenue Office of Manufacturers Trust Company in New York City. Skilled professional craftsmanship has created a structure unlike any other financial institution in the world. In its creation, the designers have employed most recent developments in structural and operational techniques. Among them is the space-saving high velocity air distribution system, using the Uni-Flo High Velocity Air Valves to supply conditioned air quietly, effectively for comfort of patrons and employees.

Architects: SKIDMORE, OWINGS & MERRILL. *Mechanical Engineers:* SYSKA & HENNESSY. *Air Conditioning Contractor:* BAKER SMITH, INC. *Interior Design Consultant:* ELEANOR LEMAIRE.

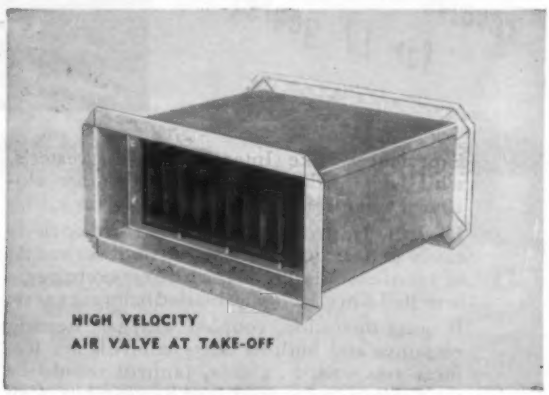


Uni-Flo Rectangular Diffusers are so inconspicuous they are practically invisible in this third-floor office. Mounted in aluminum strip, diffusers lead directly from air valves installed above luminous ceiling panels. Individually adjustable diffusers simplify system balancing.

Like a modern showcase, the interior of Manufacturers Trust Company's office gleams with light on a rainy night. Huge 10x22 foot panes of plate glass face the second floor mezzanine. Unusual air conditioning problems posed by the glass walls were solved satisfactorily.



No fixed teller positions is a new idea in commercial banking. During busy hours, tellers roll mobile currency buses along the line to make room for extra help. Uni-Flo Rectangular Ceiling Diffusers blend with modern luminous ceiling construction providing inconspicuous air distribution.



One Uni-Flo High Velocity Valve can serve several diffusers when installed at a low velocity branch duct take-off from a high velocity trunk duct. Or a "package" is available, consisting of an air valve, sound control chamber, and single diffuser.

. . . get reliable information and performance data from the pioneer in high velocity systems!

Phone nearby Field Office

or write us for your copy of Uni-Flo High Velocity Catalog No. 6598. Fully illustrated manual on high velocity applications and techniques.

Barber-Colman Company

DEPT. W, 1101 ROCK ST., ROCKFORD, ILLINOIS, U.S.A.

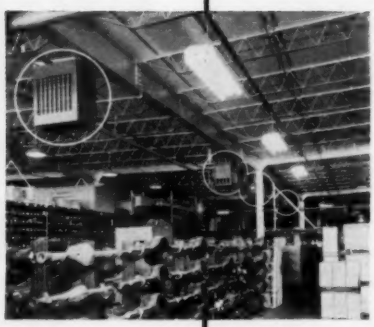
Field Offices in Principal Cities

Air Distribution Products • Automatic Controls • Industrial Instruments
Aircraft Controls • Small Motors • Overdoors and Operators • Molded Products • Metal Cutting Tools • Machine Tools • Textile Machinery.

Since 1937 over 700 *Janitrol* Unit Heaters installed in

INTERNATIONAL—HARVESTER PLANTS

Janitrol's trouble-free service results in re-specifying for 17 years!



Photographs show International Harvester's Denver plant, one of many that is Janitrol equipped to provide ideal working conditions.

Experiences, like International Harvester's, with Janitrol dependability speak more eloquently than any mere advertising claims.

Part of Janitrol's superior performance is easily understood by this record: less than ¼ of 1% of over a million Janitrol heat exchangers installed since 1940, have failed from any cause.

If quiet operation, coupled with fast heating response and built-in safety controls are features you want . . . then, Janitrol should be your selection for your best heating buy. Call a local Janitrol factory authorized dealer, he is listed under "Unit Heaters", yellow pages, your phone book.

Write today . . .
Get your copy of the "Businessmen's Blue Book of Better Heating", it's full of useful information on the proper installation of unit heaters.

Janitrol
GAS-FIRED UNIT HEATERS

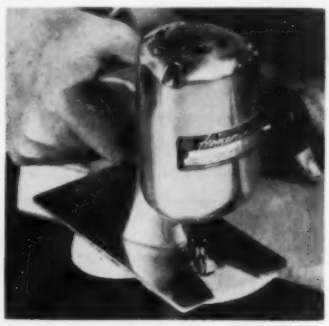
Janitrol Heating
& Air Conditioning Division
Surface Combustion Corporation
Columbus 16, Ohio
In Canada: Alvar Simpson Ltd.
Toronto 13

ALSO MAKERS OF *Surface* INDUSTRIAL FURNACES AND *Kathabar* HUMIDITY CONDITIONING

EQUIPMENT DEVELOPMENTS

Continued

Feature is means of restoring operation should magnet be lost due to violent surge in line. If this happens, follower will drop below zero line on scale. Magnetic bond restored when valve head closed momentarily.



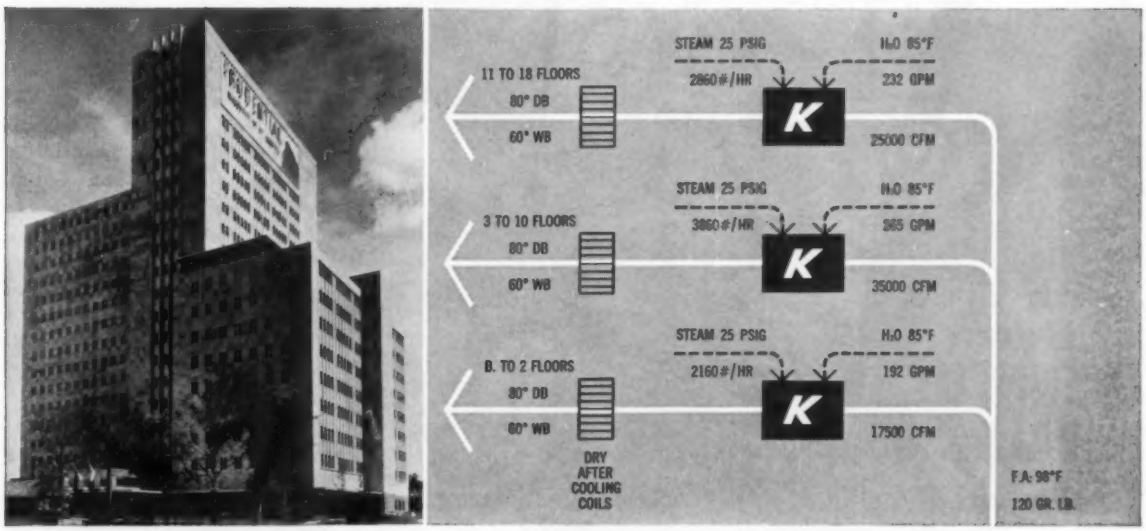
Portable Electric Tool . . .

. . . designed to combine functions of jig saw, jointer, router, shaper table —Porter Cable Machine Co., Syracuse 8. Useful to heating, air conditioning contractors; hotel, real estate maintenance crews, says company. "Routo-Jig" has 24,000 rpm, a-c/d-c motor.

Water Softeners . . .

. . . in commercial series of four automatic models—Bruner Corp., 4763 N. 32nd St., Milwaukee 16. Smallest model uses 1¼in. pipe size, others use 1½ in. Flow rates range 20 to 50 gpm. Recommended by company for apartments, laundries, motels, restaurants, schools, small factories and hotels. Feature disc type, water lubricated, multiport valve designed to cycle through four positions of backwash, brine and slow rinse, rapid rinse, service.

Dry comfort for health at Prudential



The Prudential Insurance Company of America knows that truly comfortable air has two dimensions: the right temperature *and the right humidity*. Their full-dimensional air conditioning reflects this modern thinking: they use the Kathabar system for humidity control, conventional cooling for temperature control.

Kathabar units dry fresh make-up air to absorb the moisture load of the entire building. This reduces refrigeration requirements for sensible cooling. Dry air eliminates the shock of ordinary air conditioning. Dry air protects health by eliminating wet coils where bacteria thrive.

The team of Kathabar humidity conditioning and refrigeration works well in many comfort and industrial applications, because each does the job it is best suited for. Find out how you can profit by the experience of Prudential and many others.

write for the Prudential story today

Kathabar®
HUMIDITY CONDITIONING

SURFACE COMBUSTION CORPORATION, TOLEDO 1, OHIO

KENNEDY

gives you the answers to your Valve questions . . .

with the *New* KENNEDY

VALVE Check Charts . . .

show you at a glance *How, When, Where* to use the correct valve to fit the job!

Now you can tell at a glance the correct KENNEDY Valve to use on a specific job . . . and why! These new valve Check-Charts show you the important features of the various types of KENNEDY Valves and explain their proper installation and use. Show you which valves go where . . . list specific Figure Numbers for accurate selection . . . describe why that valve should be used . . . and even suggest additional uses for Kennedy Valves.

One chart describes Kennedy Bronze Valves and its companion chart lists uses and conditions for Iron-Body Valves.

Designed for fast, easy reference, contains the answers to most of your valve questions. Large enough (16½" wide x 25" deep) for easy reading and hangs right on your wall in your office or shop.

Here are long-needed valve Check-Charts that give you quick, correct information and show you how and why certain valves are built for specific jobs. Get your Kennedy Valve Check-Charts today!

• GET YOUR KENNEDY VALVE Check Charts NOW! . . . ask your nearest KENNEDY Distributor or WRITE direct.

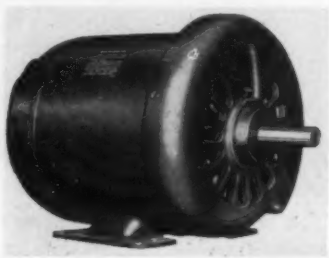
THE KENNEDY VALVE MFG. CO.
1021 E. WATER ST. ELMIRA, NEW YORK
• VALVES • PIPE FITTINGS • FIRE HYDRANTS
OFFICE-WAREHOUSES IN NEW YORK, CHICAGO, SAN FRANCISCO • SALES REPRESENTATIVES IN PRINCIPAL CITIES

EQUIPMENT DEVELOPMENTS

Continued

Gamma Ray Projector . . .

. . . designed for radiography of large diameter, heavy walled pressure vessels; for heavy fillet and butt welding assemblies—M. W. Kellogg Co., 225 Broadway, New York 7. In three sizes weighing 75, 250, 2900 lb. Requires no electricity, no control board, no maintenance beyond replenishment of radio isotope, can take picture of 360 deg, says company. As safety feature, shutter closes positively to shield workmen.



Fractional Hp Motor . . .

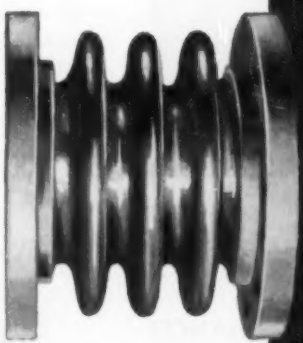
. . . added to company's totally enclosed fan cooled motor line—Century Electric Co., 1806 Pine St., St. Louis. In new NEMA frame sizes. Shown is ½ hp model with cited features: sturdy aluminum rotor with skewed laminations, integrally cast ventilating fan for operation in either direction, "Six Layer Insulation" for the stator windings, availability of NEMA standard "P" and "C" brackets for bolting motor to machine or machine to motor.

Radiant Baseboard . . .

. . . designed for simplified installation—Kritzer Radiant Coils, 2901 Lawrence Ave., Chicago 25. "K" line unit ends snap onto rolled front, over top and back without use of

The Badger Non-Equalizing

- Absorbs Thermal Expansion
- Minimizes Vibration
- Compensates for Ground Settlement or Piping Misalignment



Typifying Expansion Joint Engineering at its Best

EXPANSION JOINT of Many Uses

- Protects Costly Equipment Against Excessive Pipe Stresses
- Prevents Loss of Valuable Materials Flowing Through Pipe Lines
- Eliminates Maintenance Costs

The non-equalizing expansion joint is designed for use where pressures are low and thermal expansion is moderate. Available in copper and stainless steel in sizes up to and including 72" in diameter. Larger sizes and other materials can be furnished to meet special requirements. Also available in oval or rectangular shapes.

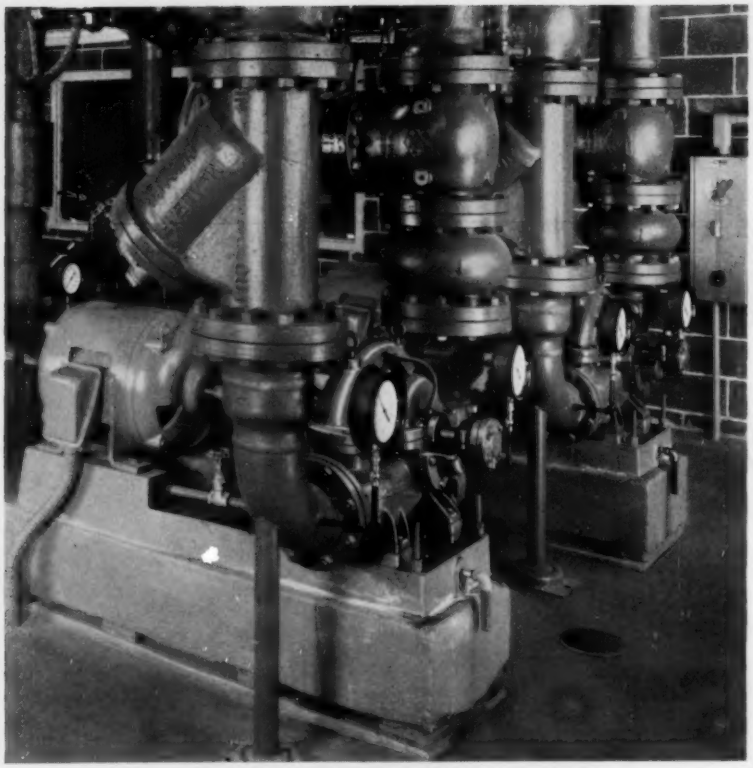
The Badger Non-Equalizing Expansion Joint can help you solve many of your piping problems. For full information, contact our nearest Sales Representative today.

BADGER MANUFACTURING COMPANY

Original and Sole Manufacturer of Badger Expansion Joints

230 BENT STREET, CAMBRIDGE 41, MASS. • 60 EAST 42nd STREET, NEW YORK 17, N.Y.

Representatives in Principal Cities



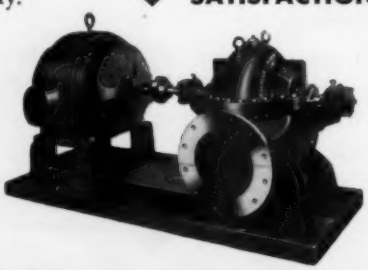
Will the PUMPS Match The Exellence Of Your Installation?

The wrong pump can spoil the most perfectly planned job — the right one helps make it a lasting success! "Buffalo" Pumps like the Double Suction Type SL below (for clear water service) have earned the reputation for reliable performance over and over. The "Buffalo" Q Factor — *the built-in Quality which provides trouble-free satisfaction and long life* — goes into every "Buffalo" Pump you specify.

WHY TAKE A CHANCE? PICK "Buffalo" THE PUMPS PROVEN BY 78 YEARS OF SATISFACTION.

YOUR "BUFFALO" REPRESENTATIVE

is ready with competent help in selecting the right pump for any problem you may have. Graduate Engineers, factory and field trained. In all principal cities. Call on your nearest one!



BUFFALO PUMPS, INC.

171 MORTIMER STREET BUFFALO, N. Y.

Subsidiary of Buffalo Forge Company

Canada Pumps, Ltd., Kitchener, Ont.

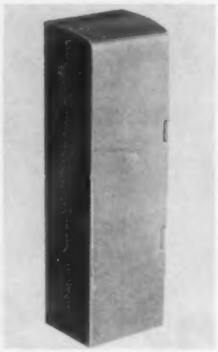
Sales Representatives in all Principal Cities

"Buffalo" PUMPS

A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID

EQUIPMENT DEVELOPMENTS

Continued



tools, says company. Extension to floor with its turned back lip acts to hide supply or return riser without requiring additional floor plate. Wall strips can be used as finishing strips against wall in wall-to-wall installation, or as joint covers in center of long run.

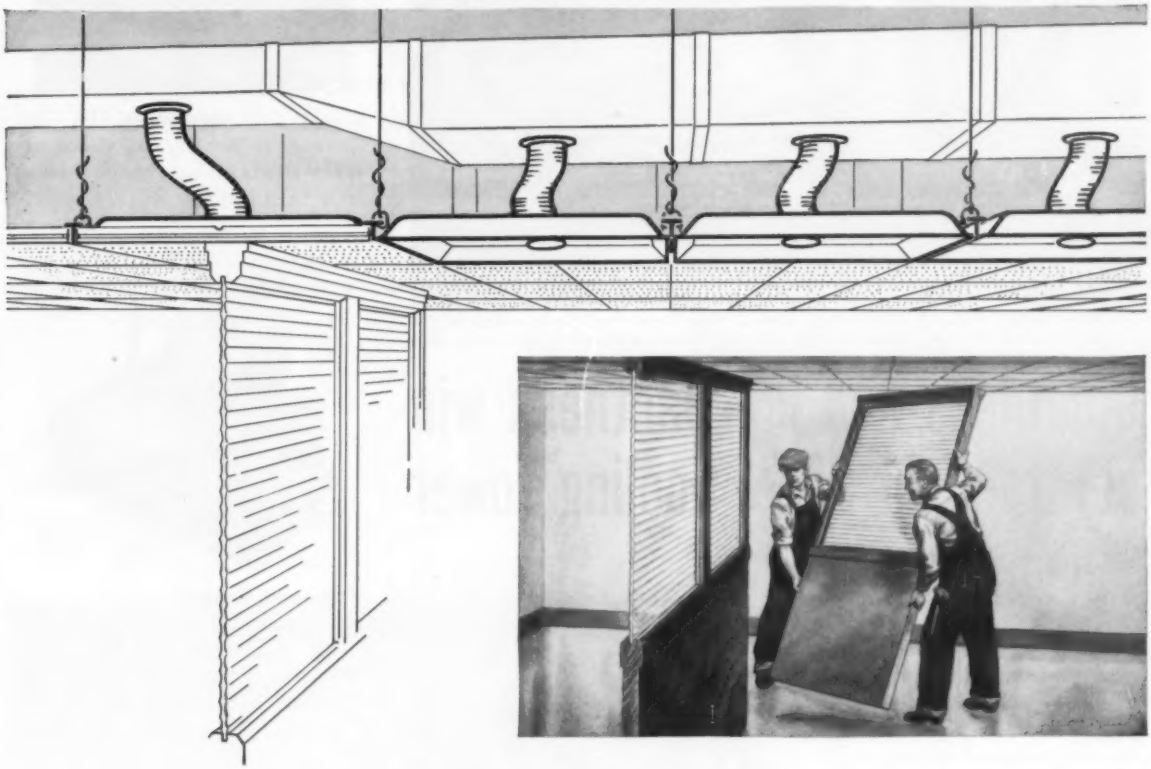
Water Pressure Relief . . .

. . . valves with increased ratings, new series number—Watts Regulator Co., Lawrence, Mass. Increased capacities in sizes ranging 1 to 2 in. in N 174 series. Designed to meet requirements of ASME low pressure heating boiler code. Series, together with No. N 74, offers six sizes ranging ¾ to 2 in. with capacities for pressure settings 30 to 150 psi.

Hand Drill . . .

. . . with self sharpening diamond bit for masonry, glazed tile—Molco Drilling Machine, Inc., 1100 20th St., N.W., Washington 6, D.C. Operates at 3200 rpm. Is equipped with integral water injection system which forces water down center of drill bit to act as cooling agent. Adapters allow bit size differences of ½ to 2

eliminates air conditioning problems when relocating partitions...



multi-vent®

LOW VELOCITY AIR DIFFUSERS

For architects and engineers designing air conditioned modular office space, Multi-Vent solves a troublesome problem. Multi-Vent air diffusing panels, once installed flush in the ceiling, need not be moved, altered in any way, or even adjusted when partitions are moved to suit tenants' changing needs.

Since Multi-Vent introduces conditioned air through the perforations in standard acoustical ceiling pans at low velocity, and since the air is gently diffused downward into the room, there is no "throw" or "blow" to bounce off nearby partitions. It is for this reason that a partition may actually bisect a Multi-Vent panel without affecting comfort conditions in the surrounding area.

Write for detailed literature and name of representative in your area.

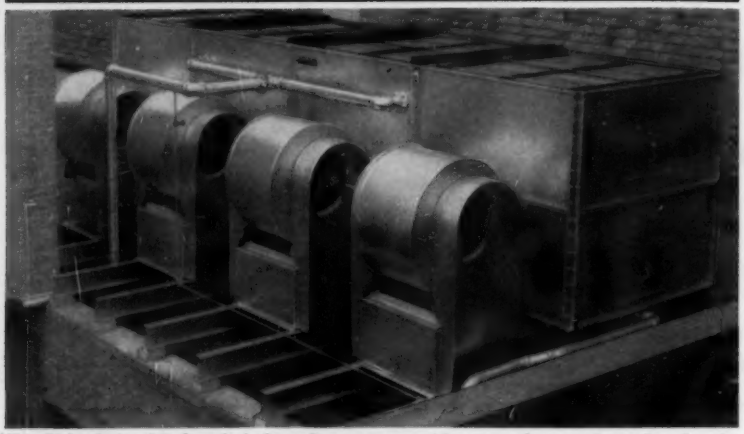
multi-vent division of THE PYLE-NATIONAL COMPANY

WHERE QUALITY IS TRADITIONAL

1373 North Kostner Avenue, Chicago 51, Illinois

SALES AND ENGINEERING REPRESENTATIVES IN PRINCIPAL CITIES OF UNITED STATES AND CANADA

COOLING TOWER NEWS



This Binks Series 3-B forced draft cooling tower provides more than ample cooling for the 160 tons of air conditioning needed for this university chapel...and does it extremely quietly.

Quietness and compactness win contract for Binks Cooling Tower

Leading Southern University picks Series 3-B Tower for chapel roof.

These modern forced draft, low silhouette, cooling towers featuring the dry blower air propulsion system, are designed for use where high cooling efficiency is demanded, combined with whisper-quiet performance and compactness. Squirrel cage blowers supply ample air movement at tip speeds far less than noisy propeller-type fans.

High cooling efficiency is obtained due to thorough water break-up from Binks patented Rotojet nozzles, combined with internal redwood nailless decking. They also feature counter-current operation with air movement in opposite direction to water flow.

Heavily galvanized, these towers reduce maintenance to a minimum. Interior surfaces are fully sprayed with a tough mastic coating. The air propulsion assembly is located in the dry air stream to protect it from corrosion. Series 3-B towers are completely shop fabricated, ready for easy assembly.

The compact design and low silhouette of this tower keeps it out of sight from street level.

VISIT US IN BOOTH 134 at the 9th Exposition, Air Conditioning and Refrigeration Industry, or write direct to the address below for full information about these high efficiency cooling towers.

Binks
EVERYTHING FOR WATER COOLING

A COMPLETE LINE OF NATURAL DRAFT AND MECHANICAL DRAFT COOLING TOWERS AND INDUSTRIAL SPRAY NOZZLES

Binks Manufacturing Company
3118-38 Carroll Ave., Chicago 12, Ill.

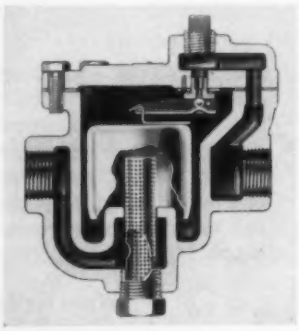
REPRESENTATIVES IN PRINCIPAL U.S. & CANADIAN CITIES • SEE YOUR CLASSIFIED DIRECTORY

EQUIPMENT DEVELOPMENTS

Continued

in. ID. Drill operates on 110 volts. Designed to cut holes in glazed tile and brick, concrete, granite, marble, other hard building materials.

Vacuum Pump . . .
. . . redesigned to reduce height, increase vacuum—Leiman Bros., Inc., 102 Christie St., Newark 5. Rotary air pumps' overall height reduced 33 percent. Vacuum increased to as low as 0.4 mm mercury absolute. Improvements facilitated by new automatic oiling system placed under pump instead of on top. When used for pressure, pumps provide 15 to 20 psig range.



Bucket Steam Trap . . .
. . . designed to prevent loss of prime —Sarco Co., Inc., Empire State Bldg., New York 1, N.Y. Retains prime under conditions such as light loads,

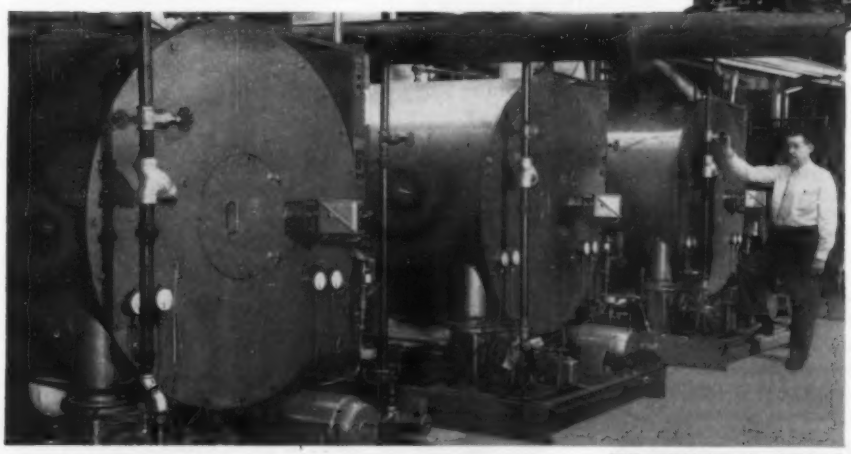
How improved heating helped this hotel clean up....FOUR WAYS

York-Power "Steam-Pak" generators reduced air pollution, saved labor, saved fuel costs, improved service.

Air pollution by coal dust and ash from coal-fired boilers was a serious problem for the luxurious Marott Hotel in Indianapolis . . . and heating costs kept climbing.

York-Power engineers were called in, and they came up with the answer that saved time and money all along the line.

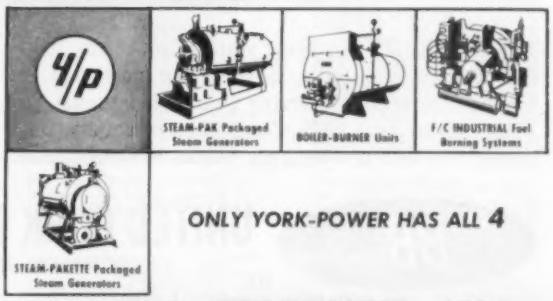
These engineers specified four York-Power "Steam-Pak" Generators. These oil and gas-fired units supply both hot water and heat for the entire building, as well as process steam for the kitchen cookers, steam tables, and dish washers for 14 dining rooms.



"Fuel savings of 10 to 15% have resulted in the face of increased business" writes Paul Crim, hotel engineer. "In addition the hotel is far easier to keep clean, and we are greatly pleased with the labor savings, heat dependability and uniformity 24 hours a day.

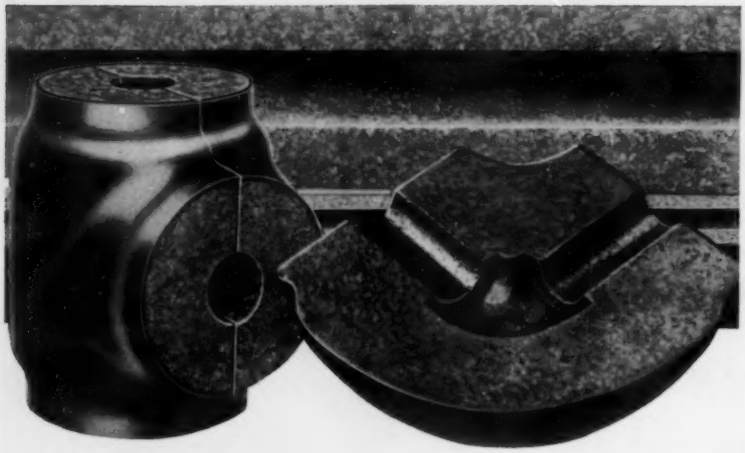
Showing York-Power Steam-Pak generators installed in Marott Hotel. Three at left are 125-hp. low pressure units burning economical No. 6 fuel oil. Far right is 90-hp. high-pressure unit using either No. 6 fuel oil or natural gas.

Find out how York-Power Steam-Paks can save money and solve your heating problems too. Write for complete York-Power story today.



ONLY YORK-POWER HAS ALL 4

YORK-SHIPLEY, INC.
YORK, PENNSYLVANIA



UNITED CORK PIPE COVERING

Light Duty Thickness (Ice Water)	to 30° F
Medium Duty Thickness (Brine and Ammonia)	to 0° F
Heavy Duty Thickness (Heavy Brine)	to —25° F or lower

For all standard pipe sizes and fittings. Molded of compressed pure granulated cork, finished with moisture-proof mineral mastic.

LARGER STOCKS...FASTER DELIVERY...PERSONAL SERVICE

United Cork Companies have expanded their facilities to include the production of cork pipe covering. Increased quantities of most frequently used sizes are now available at key points coast to coast . . . in either distributor or branch warehouse stocks . . . thus insuring fast delivery of your installation requirements.

CORK. . . STILL UNSURPASSED AS A COLD LINE INSULATOR

- Extremely low thermal conductivity
- Saves at least 80% of refrigeration lost from bare piping
- Easily economically applied
- Permanent and durable, lowest long-term cost
- Does not support combustion
- Neat, sanitary, vermin-proof
- Has no capillarity

YOUR INQUIRY will bring you specifications, helpful installation data, descriptive material on United's cork pipe covering . . . and patented BB (block-baked) 100% Corkboard specially processed for low temperature work. No obligation.

UNITED BB CORKBOARD

SEE OUR CATALOG IN SWEET'S

UNITED CORK COMPANIES

1 CENTRAL AVE., KEARNY, NEW JERSEY

Manufacturers of cork insulation for almost a half century

Engineering offices, or approved distributors, in key cities — coast to coast.

EQUIPMENT DEVELOPMENTS

Continued

rapid pressure drops, partial vacuum in return line caused by night shutdowns. In sizes ½ to 2 in., pressures to 250 psi.

Flush Clip . . .

. . . for use with impaled insulation—Johns-Manville, 22 E. 40th St., New York 16. Fits over pin which is welded to metal duct. When pushed home, pin is flush with insulation. Is said to assure smooth, unbroken surface on exterior of air conditioning duct insulation. Has no sharp projections, safeguards personnel, will not puncture or tear vapor barriers, says company. Is designed by Graham Mfg. Corp.

Equipment Briefs . . .

FINISHING PROCESS for reducing possible breakage of intake, discharge compressor valves—Stampings Div., Detroit Stamping Co., Detroit. "Iso-Finishing" is process which hones valve edges mechanically to remove danger areas of fractures, cracks.

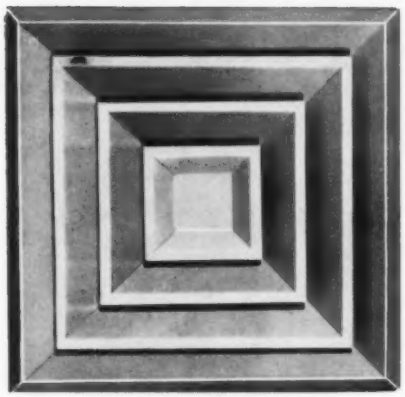
FASTENERS designed to hold plates of metal, plastic, plywood pressure tight—Southco Div., South Chester Corp., 200 Industrial Hgwy., Lester, Pa. Are said to be lightweight, positive locking. Operate at a quarter turn. Recommended by company for fastening maintenance and inspection panels on air conditioning units, other applications.

AEROSOL PRODUCT designed to prevent sticking of seasonally operated pumps—German Co., Inc., St. Louis 23. Injected under pressure

NEW!... AT CARNES

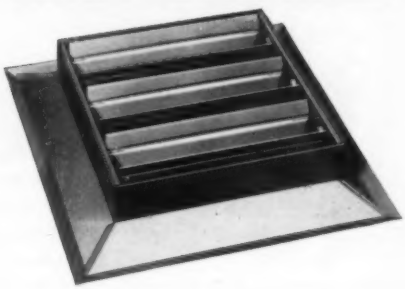
1-2-3-4 WAY AND 2-WAY CORNER SQUARE AND RECTANGULAR

CEILING DIFFUSERS



MODELS SFS AND SFR

Here is a new line of square and rectangular diffusers, by Carnes. Models SFS (surface-mounted) and SFR (for recessed ceilings)—are scientifically and artistically designed with the corner air scoop on the back side of the deflecting vanes to assure a 360° air distribution pattern. The 4-way blow diffuser, illustrated at the left, is an example of the attractive, symmetrical appearance of this new line—an improved and re-designed selection of diffusers that features extremely easy installation . . . sturdy construction . . . maximum efficiency . . . extremely quiet operation . . . attractive prices. And—the wide variety of blows makes blank-off baffles unnecessary.



MODEL IVS SQUARE AND RECTANGULAR DIFFUSER DAMPER

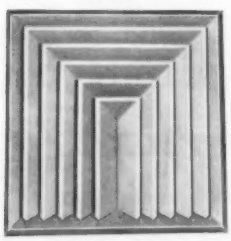
This opposed blade damper, when installed directly to the ceiling plate becomes an integral part of the diffuser. These three simple steps completely install Carnes square and rectangular diffusers and dampers:

1. Attach ceiling plate to duct with sheet metal screws.
2. Insert damper and attach to ceiling plate with four sheet metal screws.
3. Snap inner vane assembly into place—no screws or tools necessary—this assembly is held in place by spring catches.

Only a few minutes for the complete installation—and the damper is completely adjustable from the face of the diffuser—simplifying balancing.

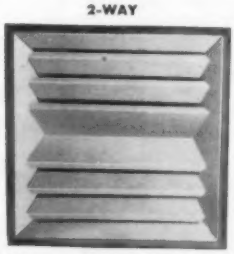
AVAILABLE IN ALL AIR DISTRIBUTION PATTERNS

3-WAY



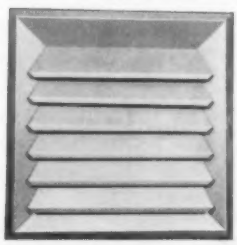
SFS-3 and SFR-3-deliver an equal portion of air evenly in three directions.

2-WAY



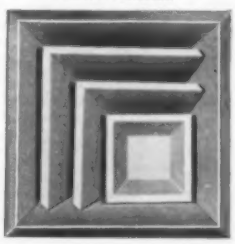
SFS-2 and SFR-2-ideal for long rooms and corridors.

1-WAY



SFS-1 and SFR-1-in all sizes, available with vanes running in either direction.

2-WAY CORNER



SFS-2C and SFR-2C- for room or corridor corners where right angle blows are necessary.

FOR COMPLETE INFORMATION, WRITE

CARNES CORP.

Verona, Wisconsin

Tata Iron and Steel Company's new engineering office building at Jamshedpur, India. Tata is the foremost steel company in India. Vilter air conditioning serves the entire building.

Vilter air conditioning installation in this office building. Shown are the two Vilter refrigeration units.

Q - How do they beat the 110°F. heat in Jamshedpur, India?

A. with Vilter AIR CONDITIONING EQUIPMENT that costs less to own*

In Jamshedpur, India, summer temperatures that often soar to a bake-oven 110° F. are no problem to the engineering staff of India's largest steel mill, The Tata Iron and Steel Company. The company's new engineering office building has Vilter air conditioning that keeps the interior at just the right temperature and humidity.

Two Vilter condensing units are used. Each unit consists of one six-cylinder VMC compressor, oil separator, 60 horsepower motor and a two-pass condenser. Each unit is fully automatic and designed to deliver 60 tons of refrigeration. The smooth uninterrupted performance of this equipment has won the full approval of the Tata officials.

Tough climatic conditions such as those at Jamshedpur require careful engineering to provide the desired temperature and humidity conditions without causing a shock when entering or leaving the building. Combine long years of successful design experience with the industry's soundest line of equipment and you know why Vilter can custom build an air conditioning system to serve your special needs. Call on your Vilter representative or distributor today.

Sold and Installed by Universal Refrigeration Corp. Ltd.
Vilter Distributor in Calcutta, India

* Savings in low first cost are not the complete answer when considering the installation of refrigeration equipment. But savings in terms of years of extra service, reliable performance and minimum maintenance—that's where Vilter excels in low-cost ownership.

QUALITY CRAFTSMANSHIP that lasts . . .

ENGINEERING DESIGN that guarantees performance

Vilter REFRIGERATION and AIR CONDITIONING

THE VILTER MANUFACTURING COMPANY, Milwaukee 7, Wisconsin

Air Units • Ammonia & Freon Compressors • Booster Compressors • Baudelot Coolers • Water & Brine Coolers • Blast Freezers • Evaporative & Shell & Tube Condensers • Pipe Coils • Valves & Fittings • Pakice & Polarflake Ice Machines

EQUIPMENT DEVELOPMENTS

Continued

through drain hole into pump housing cavity after draining pump. Is said to provide protection against corrosion during pump down time.

PORTABLE HUMIDIFIER for apartments, offices where permanent installation not desired—Research Products Corp, Madison 10, Wis. Controlled humidistat provides humidity only when needed. Water is passed through evaporating pad where it evaporates and is introduced into building as vapor. Has independent heat source to evaporate water.

EQUIPMENT COATINGS designed to provide corrosion protection for equipment—Graver Water Conditioning Co., 216 W. 14th St., New York 11. At installation time, five to seven coats of paint applied using successively different colors for each coat. As coating wears off, operator can tell, by what color is showing, how much wear has occurred.

CORNER PADS for sheet metal —By-Buk Co., 4314 W. Pico Blvd., Los Angeles 19. Designed to prevent scratching, gouging of finished surfaces during shop handling of sheet metal. Made of thick, treated paper stock said to have high resistance to piercing. Pressure sensitive adhesive holds them securely during handling operations, say company. ∓

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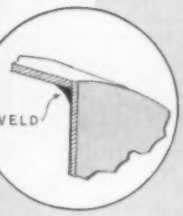
Is the quick, economical way to find what you're looking for. Check the classified page each and every issue for real bargains and hard to find items. It's a quick and sensible means too, of disposing of tools, equipment, and anything else for which you no longer have use. Check the classified page for rates.

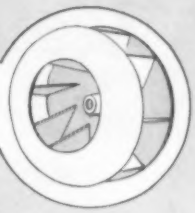
7 KEYS *to smooth*
FAN SYSTEM PERFORMANCE

Rugged Construction



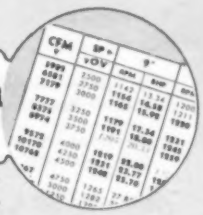
Ample gauges, strong bracing, parts predominantly welded. Housing seams welded to assure tightness.

Sound Design

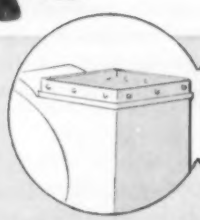


Over 60 years engineering experience — all types and applications.

Ease of Application



Complete Line — Standardized proportions—Test-proved ratings — selection simplified by quick-finding tables.

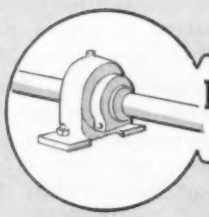


Simple Installation

Reinforced outlets. Ready-to-use connections — smooth finishes, inside and out.

Operating Economy

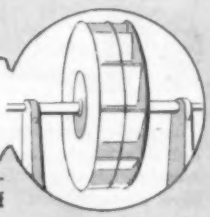
Streamlined air passages — closely fitted running parts — accurate contours.



Low Maintenance

Finest bearings, shafts, fastenings, and other components.

Long Life



Precision dynamic balancing, thorough inspection of parts and assemblies.

PLUS — the complete plant facilities and personnel to deliver the equipment to your order

Bayley

BLOWER COMPANY

1823 South 66th Street • Milwaukee 14, Wisconsin

This extremely flexible air conditioning duct will save you as much as 32%

- eliminates elbows, clamps and special fittings — saves material
- proved flameproof and waterproof by rigid tests — for long life
- saves up to ⅔ installation time — which saves your money
- broad temperature range — 0° to 250° F. — for broad use

Thermaflex will cut your installation costs substantially when you use this rugged, light-weight duct to connect main line ducts with diffusers, sound boxes and other types of distributors in any air-conditioning system — high or low pressure.

Because Thermaflex is so *flexible*, it easily compensates for misalignment between main line and outlets. It's easy to work with in tight quarters, too — snakes around obstructions and provides a direct, air-tight connection without costly elbows and complicated rigid ducting.

Thermaflex is a snap to install — you can cut it with a knife and side cutters. Brush it with adhesive and slide it over the metal connecting outlet. This is all that's required for a positive, air-tight joint.

Available in 12-foot lengths, 2" to 12" diameter. Write Dept. 7 today for Bulletin 12C1. It shows you how to do a better installation job and cut your costs at the same time.

Visit us at the Exposition of Air Conditioning and Refrigeration Industry — Atlantic City, November 28 — December 1. Booth No. 216.

Flexible Tubing

CORPORATION
GUILFORD, CONNECTICUT
LOS ANGELES 64, CALIFORNIA

RECENT TRADE LITERATURE...

▸ *AIR POWER DEVICES*—New 8 page booklet contains illustrations, descriptions of company's "Air Motor," its interchangeable valves as well as typical application photographs. Also covers "Controlled Air-Power" drill press feeds, vises, "Hydro-Checks," rotary feed and index tables, self contained drilling units, valves, cylinders. Bellows Co., 222 W. Market St., Akron.

▸ *AMMONIA VALVES, REFRIGERATION PRODUCTS*—Catalog contains illustrations, specifications for semi-steel shutoff, expansion, bolted bonnet shutoff, and tee valves; all-steel gage sets, all-steel line, purge, needle point relief valves; three-way valve. Cyrus Shank Co., 4646 W. 12th Pl., Chicago 50.

▸ *ASBESTOS SHEET PACKING*—Data sheet gives specifications, uses for 11 grades of asbestos sheet packing. Grades include high grade sheets for severe conditions; synthetic bonded types, neoprene and Hycar, where oil and solvents are involved; competitive qualities for general purpose and where price may be factor. B. F. Goodrich Co., Industrial Products Div., Akron.

▸ *BLOWERS*—Engineering details, technical specifications of "Standardaire" axial flow, positive displacement blower contained in new 4 page folder B-154. Includes cutaway illustration of interlocking main and gate rotor assemblies, cross-sectional diagram to show component parts, performance charts and charts to aid selection. Read Standard Corp., 370 Lexington Ave., New York 17.

▸ *BOILER PLANT INSTRUMENTATION*—New 24 page catalog 55-605-83 gives data on company's line of power plant instruments, control systems. Contains photographs, schematic drawings of combustion guides;

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Each is a complete packaged unit, designed to serve a particular purpose.

So when you use our functional spring hangers . . . which have the Blaw-Knox patented *internal swivel action* . . . and our constant support spring hangers and vibration eliminators, you get custom-made results. And that holds good for rigid hanger assemblies and overhead roller assemblies.

Proper selection cuts your engineering time and expense . . . yet enables you to meet the most exacting standards. Each is ready to install, so you eliminate expensive cutting, threading and assembling in the field.

Our engineers, who have solved many tough hanger and piping vibration problems, are always available to both design and make recommendations for your hanger requirements.

For more information on our complete line, write for your copy of Bulletin No. 54.

BLAW-KNOX COMPANY
Power Piping and Sprinkler Division
Pittsburgh 33, Pennsylvania

BLAW-KNOX **PIPE HANGERS**

Complete line of functional spring hangers • constant support spring hangers • rigid hanger assemblies • overhead roller assemblies • supports • vibration eliminators . . . plus complete prefabricated piping systems for all pressures and temperatures

MULTI-FUNCTION CEILING

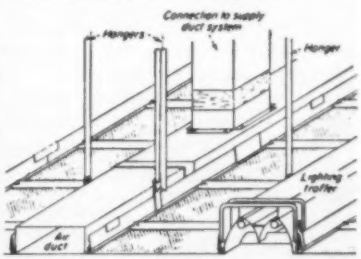
This man is installing a SIMPLEX Radiant-Acoustical ceiling. When he is finished the customer will receive, from one integrated unit, heating, cooling, ventilation, humidity control, noise reduction and lighting.

The SIMPLEX system combines the speed of response and installation economy of forced air systems with the superior comfort of radiant heating and cooling.

OUTSTANDING FEATURES

- Uses 40% to 60% less air than straight air systems.
- Rapid, responsible one trade installation.
- Healthy, draft free heating, cooling and ventilation via one medium—air.
- A clean, permanent finished aluminum ceiling surface free of conventional air diffusers and dirt rings.
- Effective noise reduction.
- Immediate action—no uncomfortable time lag on either heating or cooling cycle.

All for little more than the cost of a quality suspended ceiling alone.



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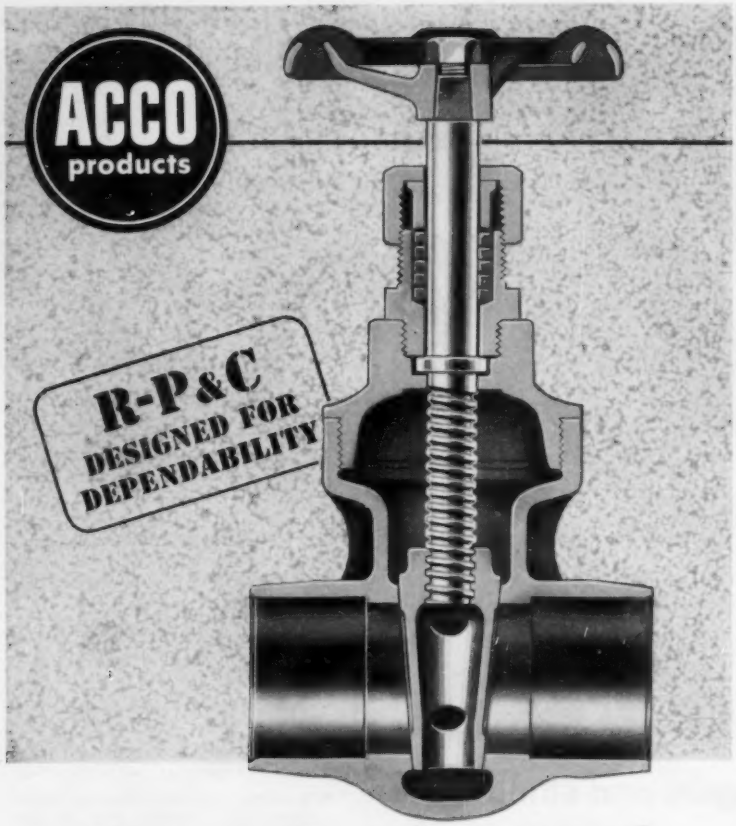


Now—a Complete Line of R-P&C Solder End Valves

BRONZE GATES, GLOBES, CHECKS

• Now you can get R-P&C solder end valves similar to the **Fig. 90 gate valve** above in globe valve and check valve styles. They have been especially developed for use with K, L or M copper tubing on hot and cold water, or low pressure steam lines in plumbing, heating and air conditioning systems.

All are rated for 125 lbs. in steam service, or 200 lbs. with oil, water or gas. Gates are provided in sizes from ⅜″ to 3″, globes from ¼″ to 2″, checks from ⅛″ to 2″.

FREE SLIDE RULE
Valve selector slide rule gives all dimensions for iron body and steel valves in pressure classes from 150 to 1500 lbs. Write for yours.

These new valves reflect the quality construction features, typical of the complete R-P&C line, which result in longer life, lower maintenance and easier installation. They are presented in a wide range of styles—for example, the gate valves are supplied with either rising or stationary stem, and solid or split wedge. Each valve is hydrostatically tested at a pressure of 350 pounds before leaving the factory.

Your R-P&C distributor has these valves in stock now—or he can get them for you. Write Reading office for complete catalog.

ACCO

R-P&C Valve Division
AMERICAN CHAIN & CABLE

Reading, Pa., Atlanta, Boston, Chicago, Denver, Detroit, Houston, New York, Philadelphia, Pittsburgh, San Francisco, Bridgeport, Conn.

R-P&C valves

RECENT TRADE LITERATURE

Continued

draft gages; flow, level, temperature, pressure instruments; combustion control systems; panels. Hays Corp., Michigan City, Ind.

▸ *CONTROLS, INSTRUMENTS*—Bulletin 100-D is index of literature available on products of company's Industrial Div. Is broken down by subject, industry, product. Covers catalogs, bulletins, specification sheets, data sheets, articles. Minneapolis-Honeywell Regulator Co., Industrial Div., Wayne and Windrim Aves., Philadelphia 44.

▸ *CORROSION—Eleven Ways To Avoid Boiler Tube Corrosion* is 8 page folder containing important data on the subject. Many causes explained in detail along with suggested methods for eliminating. Babcock & Wilcox Co., Tubular Products Div., Beaver Falls, Pa.

▸ *COUPLINGS*—New 12 page reference catalog describes "Sphereflex" line of curved root, spherical tooth couplings; provides data on installation, service factors, proper selection, specifications, lubrication. Features dimensional drawings of standard and mill motor couplings, as well as horizontal floating shaft, standard spacer, vertical shaft, vertical floating shaft types. Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia 34.

▸ *DUST CONTROL*—How to control dust in mixing, application operations in rubber goods manufacture discussed in bulletin 555-D. Bulletin gives four case histories showing how dust conditions improved using company's cloth-tube-type dust collectors. Wheelabrator Corp., 1321 S. Byrkit St., Mishawaka, Ind.

▸ *ELECTRONIC CONTROLS*—How flexibility of electronic temperature controls makes them useful in wide range of commercial heating, air conditioning installations explained in

to meet the exacting conditions of the new Los Angeles Health Center . . .

800

A-F AIR-FACTORS INC

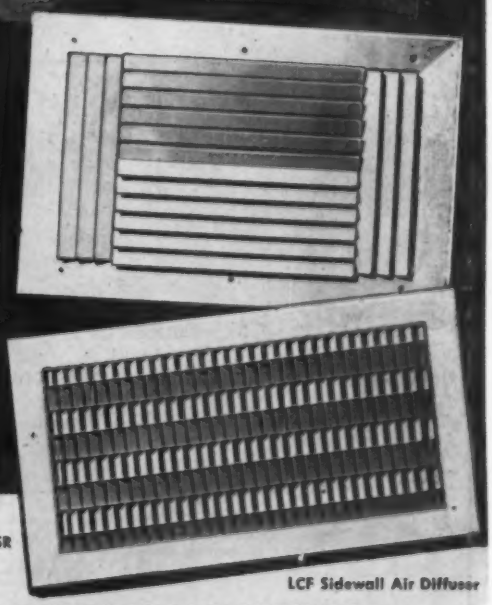
SERIES B60-SR DIFFUSERS supply and return air from the ceilings of the new Health Center Building. **SERIES LCF SIDEWALL DIFFUSERS** supply air in the lobby and other areas not accessible through the ceiling.

Lunden, Hayward and O'Connor, Architects
Ralph E. Phillips, Inc., Mechanical and Electrical Consulting Engineers
Western Air and Refrigeration, Inc., Mechanical Contractors

AIR-FACTORS B60-SR Diffusers combine supply air diffusing qualities with return air features in a single framework. These double purpose units were selected because of flexibility in sizing making possible even spacing with a resultant uniformity of design.

AIR-FACTORS Series LCF Sidewall Air Diffusing Outlets were specified to allow the necessary draftless air distribution required in a fresh air double duct system providing heat and refrigeration cooling to individual temperature controlled areas.

Write for Literature



Above
Face View
Model 4B60-SR

LCF Sidewall Air Diffuser

A-F AIR-FACTORS INC
MONROVIA CALIFORNIA

THE ONLY MANUFACTURER OF A COMPLETE LINE OF AIR DISTRIBUTION EQUIPMENT

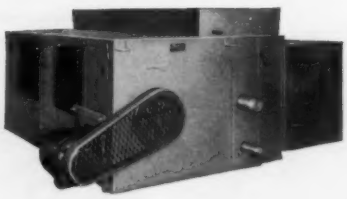
CONSISTENTLY RELIABLE

KENNARD *Engineered* AIR CONDITIONING EQUIPMENT

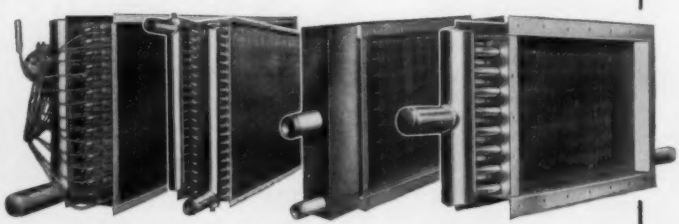
AIR CONDITIONING BLOWER UNITS

13 sizes. 300 to 21,600 CFM. Horizontal or Vertical. Catalog No. AC.

HEATING AND VENTILATING UNITS



Air Volumes 300 to 28,800 CFM. Catalog No. HV.



AIR CONDITIONING AND HEATING COILS

Direct Expansion, Water, Steam Distributing Tube, Standard Steam Coils. Sizes up to 48" wide x 132" long. Catalogs No. CC and HC.

Write for name of nearest representative and catalogs needed.

KENNARD CORP.
1817 S. HANLEY ROAD
ST. LOUIS 17, MO.

RECENT TRADE LITERATURE

Continued

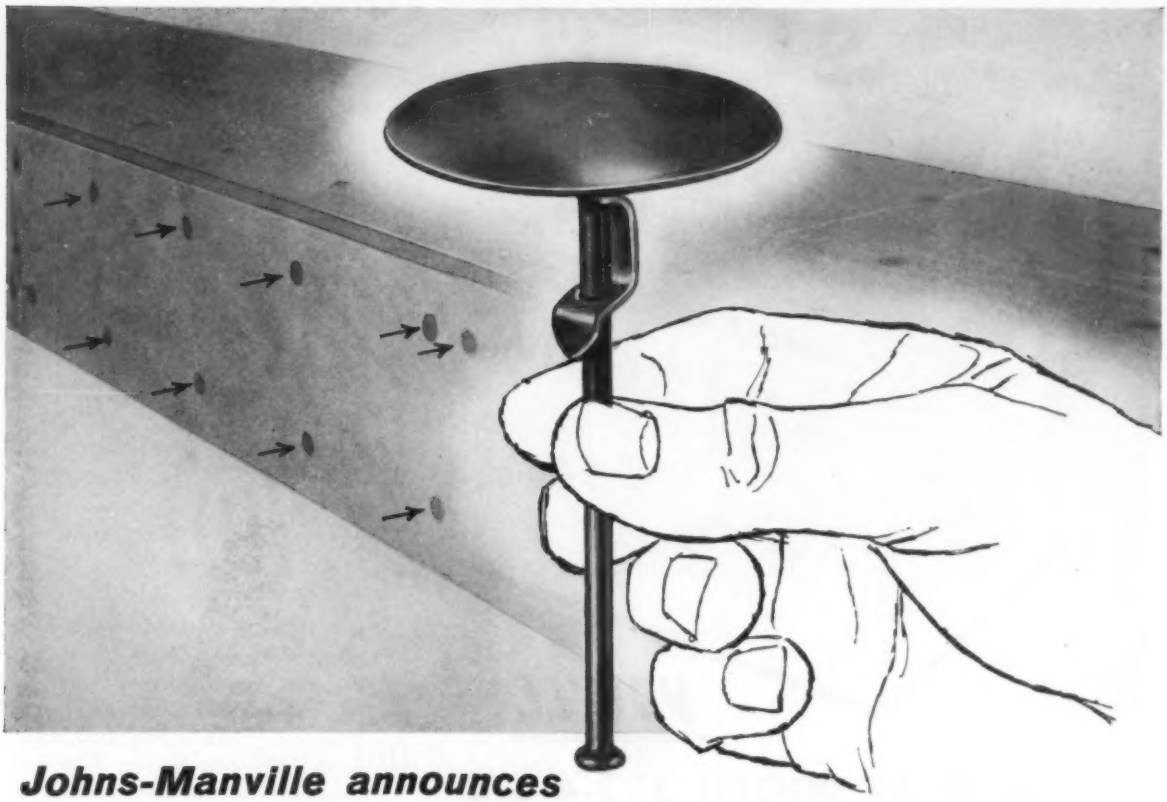
new booklet. Describes, illustrates four basic features that give this flexibility of application. Minneapolis-Honeywell Regulator Co., Commercial Div., 2753 Fourth Ave., S., Minneapolis 8.

▸ *ELECTRONIC RELAY*—Publication No. 585 covers company's electronic relay said to be capable of: complete follow through action, responding to controls from highly sensitive contact, requiring no arc operation, direct control of load operating solenoid. Design, application information; circuit description; dimensional, pricing data given in bulletin. Automatic Switch Co., 391 Lakeside Ave., Orange, N.J.

▸ *FANS*—Bulletin No. 6514 describes new "Model K Ventura" fans for industrial heavy duty exhaust applications. Outlines construction features, explains their significance. Performance data such as delivery ratings at various static pressures, fan speed, motor horsepower, quietness rating, maximum net weight given for each of 45 different units in line. American Blower Corp., Detroit 32.

▸ *GAS ANALYZERS*—Data sheet No. 10.15-14 describes applications, operation, features of "Gow-Mac" thermal conductivity type gas analyzers which use "ElectroniK" circular chart instruments for recording and control of gas concentration and purity. Minneapolis-Honeywell Regulator Co., Industrial Div., Wayne and Windrim Aves., Philadelphia 44.

▸ *GAS DETECTOR*—Reduced size, lightweight, portable gas detector for combustible gas explorations described in new leaflet G-755. Leaflet discusses automatic shutoff designed to minimize battery drain, sample drawing system engineered to cut down operator fatigue. Johnson-Williams, Inc., Palo Alto, Calif.



Johns-Manville announces

a *Flush Clip* for impaled insulation

Improves appearance **Won't tear vapor barrier**

Safeguards personnel

HERE'S HOW IT WORKS

1. Mechanic depresses insulation exposing tip of pin.

2. Pin is engaged by locking-holes on clip.

3. Clip is pushed home flush with insulation surface.

4. Vapor barrier (where necessary) is easily applied over clip.

Another revolutionary development introduced by Johns-Manville

Now . . . you can insure a smooth and unbroken finish on air conditioning ducts. For this new *Flush Clip*, developed and produced by the Graham Manufacturing Corporation of Royal Oak, Mich., firmly secures impaled insulation without sacrificing eye appeal or impermeability of vapor barrier.

Plant personnel will appreciate the neat, smooth appearance unbroken by ugly protuberances. The Graham® *Flush Clip* also provides an excellent surface for decorative or identification painting. Insulation engineers will be able to furnish a snugger fitting, more efficient job with an unbroken vapor barrier that is easily applied. Installation crews will find their work simplified and speeded—with no trimming and cutting required—and a greatly reduced injury hazard from sharp, jagged projections.

Johns-Manville's Industrial Contract Department has worked closely with the Graham Manufacturing Corporation in field-testing the Graham *Flush Clip* on industrial installations. Used in conjunction with the Graham Insul-Pin System, it has been proven to operate ideally with J-M Spintex Insulation, plain and faced. For more information and samples, contact your nearest J-M Insulation Contractor. Or write Johns-Manville, Box 60, New York 16, New York. In Canada, Port Credit, Ontario.

JM PRODUCTS

Johns-Manville *first-in* INSULATION

MATERIALS · ENGINEERING · APPLICATION

SEE IT AT BOOTH 323-4-5-6

Heat-X Hank will have several new products ready for you to see. One is the new Heat-X Heat Pump, first in the industry to incorporate extra-efficiency *Inner-Fin*® construction.

Other new products that will make your visit to the Heat-X booth time profitably spent:

- 'CCP' CAST COOLER PACKAGES.
- OIL SEPARATORS
- MUFFLERS
- PACKAGE CHILLER WITH STAINLESS STEEL STORAGE TANK
- AIR COOLED PACKAGE CHILLER
- 'PC' 5000—A 50 TON CHILLER
- HEAT INTERCHANGERS
- CAST ALUMINUM LIQUID COOLERS
- INNER-FIN CONDENSERS
- CLEANABLE INNER-FIN CONDENSERS

There'll be cut-away models, operating units . . . even a soft drink dispenser. Stop in and look over the industry's most complete line of heat transfer products.

HEAT-X, Inc.
BREWSTER • NEW YORK

RECENT TRADE LITERATURE

Continued

▸ *INSULATING VALUES—The Thermal Insulating Value of Air Spaces* is title of housing research paper No. 32 of the Housing and Home Finance Agency. Infra Insulation, Inc., 525 Broadway, New York.

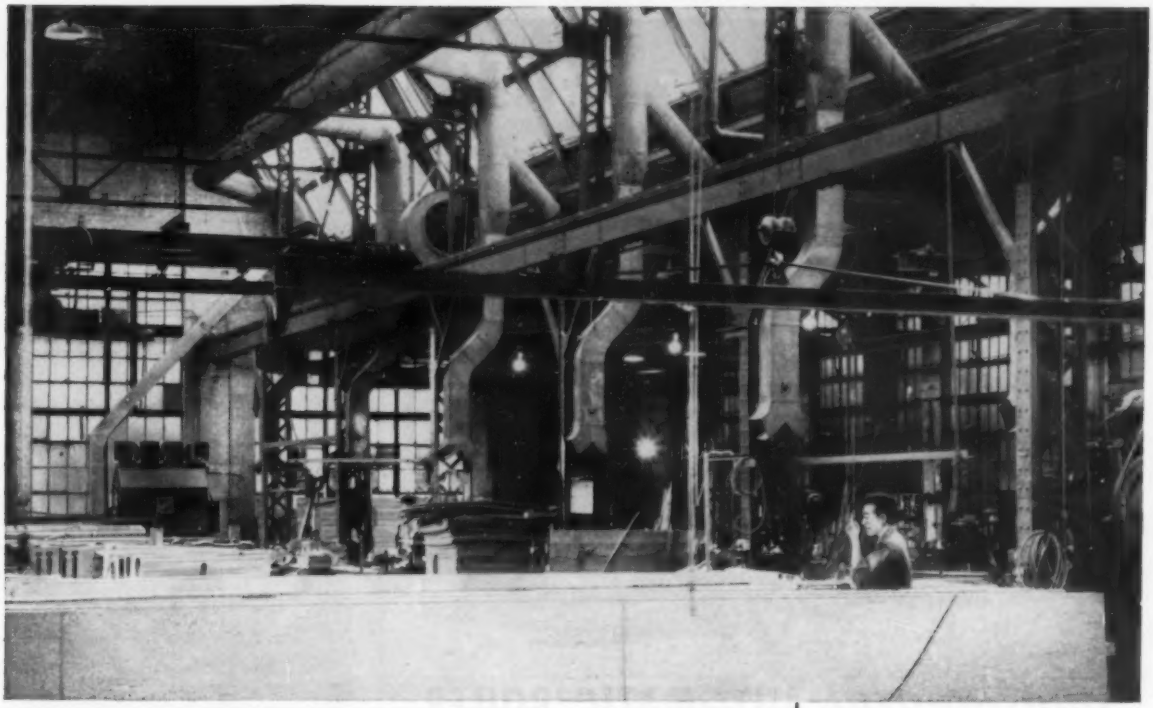
▸ *INSULATION*—Recent literature from manufacturer covers "LT-30" cork insulation for pipe and "Plasticork" for fittings; "Armatemp" mineral wool block and blanket insulation; "Armaglas" insulations for duct and hot and cold pipe lines, tanks, vessels; "Armbstos" asbestos fiber pipe covering and block. Armstrong Cork Co., Lancaster, Pa.

▸ *JET PUMP MOTOR*—New 6 page publication GEA-5902B illustrates, describes features of new "Form G" jet pump motor. Includes photographs, diagrams of insulation, ventilation, switch mechanism. Also lists dimensions, ratings, specifications according to NEMA frame sizes. General Electric Co., Schenectady 5, N.Y.

▸ *LIMIT SWITCHES*—Lever and rotating cam type limit switches discussed in new 8 page bulletin GEA-613A. Booklet contains application information, product features, ratings, dimensions. Included are lever operated snap action, small oil tight snap action, lever type double circuit, rotating cam, lever operated slow make and break time switches. General Electric Co., Schenectady 5, N.Y.

▸ *MAGNETIC STARTERS*—New 8 page bulletin GEA-6301 describes complete line of magnetic starters for air conditioning, refrigeration equipment. Describes features, ratings, dimensions. Contains wiring diagrams, catalog numbers, installation requirements. General Electric Co., Schenectady 5, N.Y.

▸ *MEASUREMENT, CONTROL SYSTEMS*—Linear variable differential transformer type measurement and control systems discussed in 6



Richards-Wilcox more than doubles heating capacity

...cuts heat operating costs in half!

Plant heating problems first began for the Richards-Wilcox Manufacturing Co. of Aurora, Illinois, during World War II. Then, the existing steam plant, operating at full capacity, could not meet the heat requirements for new production areas. Immediate solution was the addition of two warm air space heaters.

Later, a 750,000 btu Dravo *Counterflo* heater was installed to serve additional expansion. But in 1951, facing even more expansion, Richards-Wilcox plant men thoroughly surveyed their total plant heating problem.

The existing boiler had to be modernized, an additional boiler and accessory equipment had to be added. Operating costs of this contemplated step were discouragingly high! Experience with space heaters suggested an alternative that promised real economies—dismantling of the steam plant and converting the entire plant to warm air heating. This plan was adopted on a 3 year basis.

From 1951 through 1953, twenty-four Dravo *Counterflo* heaters were put into service. Richards-Wilcox personnel installed recording instruments on every unit to determine fuel consumption and efficiency. After two years of service, the records show that Dravo heaters provided more than enough heating capacity for complete worker comfort and had *cut operating costs to less than half of the former system.* Service costs, too, were 50% less than anticipated.

Such economy is only a part of the many exclusive advantages Dravo heaters can bring in heating your plant, warehouse or building. It will pay you to thoroughly investigate quality Dravo heating systems—and see the dollars and cents reasons behind every feature. For prompt information, mail the coupon today.

This Dravo *Counterflo*, on the far wall, distributes heat up to 150 feet away. Richards-Wilcox's complete Dravo system of 25 units provides 21,700,000 btu per hour to a 6 acre plant area. Ductwork visible is part of abandoned steam heating system.

At the Richards-Wilcox plant, Dravo heaters serve dual heating jobs—heating both the local area and, through duct take-offs, serve adjacent areas.

Dravo Corporation, Department A-1411
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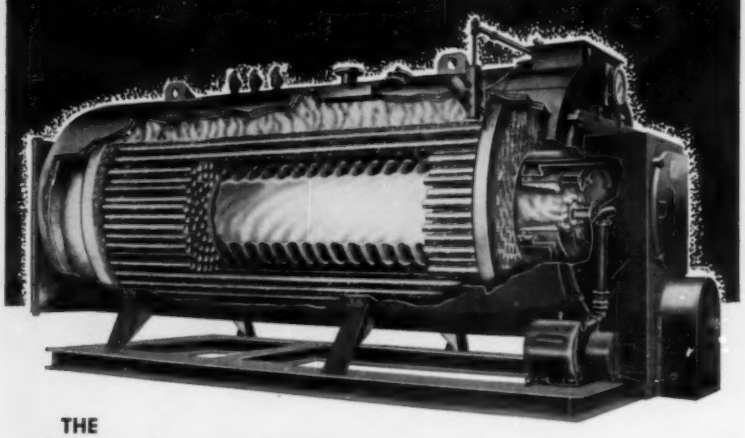

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- distributes heat evenly to the rear tube-sheet and all return tubes. This results in balanced water circulation and uniform longitudinal expansion of the entire pressure vessel.
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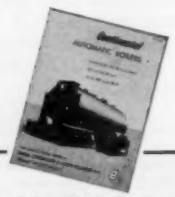

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RECENT TRADE LITERATURE

Continued

page folder. Covers transducers for force, weight, stress, linear displacement, pressure flow, liquid level; displacement indicators for indication, recording; transformer amplifiers for oscillographic studies. Daytronic Corp., 216 S. Main St., Dayton 2.

▸ *OIL BURNERS*—Folder No. N-1132 features new line of oil burners in seven models with firing range 0.65 to 20 gph. Includes descriptions, specifications. Five models illustrated. Nu-Way Corp., Rock Island, Ill.

▸ *OPEN BLAST BURNER NOZZLES*—Bulletin H-15 describes open blast burner nozzles for air/gas mixtures. Contains dimension information, operating data, installation instructions. Eclipse Fuel Engineering Co., 1002 Buchanan St., Rockford, Ill.

▸ *PIPING, EQUIPMENT INSULATION*—New 8 page booklet presents physical properties of "Foamglas" cellular glass insulation, sizes and shapes available, suggested thicknesses for temperatures ranging −50 to 800 F. Contains condensed recommended specifications, photographs of applications. Pittsburgh Corning Corp., 1 Gateway Center, Pittsburgh 22.

▸ *PIPING FLEXIBILITY ANALYSIS*—New 28 page booklet contains extensive tables, charts covering dimensional and materials properties data required for piping flexibility analysis. Enumerates new ASA code rules on expansion, flexibility. Tube Turns, Louisville 1.

▸ *PLASTIC PIPE*—New 32 page bulletin No. 24 covers high-, normal-impact polyvinyl chloride plastic pipe. Tables give corrosion resistance data compared to other piping, complete specifications. Contains charts for determining maximum operating pressures at various temperatures, head loss compared to various

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RECENT TRADE LITERATURE

Continued

flow rates. Fittings for pipe also covered. National Tube Div., U. S. Steel Corp., 525 William Penn Pl., Pittsburgh 30.

▸ *PNEUMATIC REGULATORS*—New 8 page bulletin H-2 lists pneumatic regulator equipment including filter-regulator combinations, filters and regulators, relays, purge assemblies, control panels. Illustrated with cross section and dimensional drawings. Conoflow Corp., 2100 Arch St., Philadelphia 3.

▸ *PROPORTIONING PUMP*—"Adjust-O-Feeder" heavy duty proportioning pump designed for pumping petroleum, chemical, boiler feed water additives in accurate predetermined quantities described in bulletin 1105-2. Bulletin contains capacity table, presents typical applications with schematic diagrams, lists advantages. Proportioneers, Inc., 345 Harris Ave., Providence, R.I.

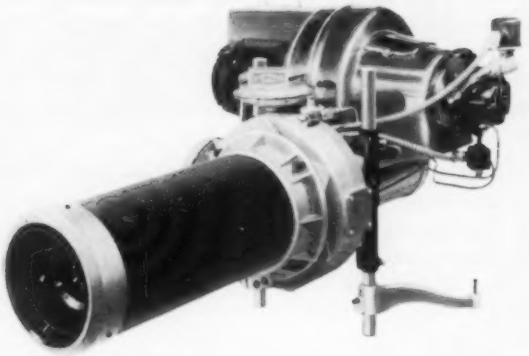
▸ *PUMPS*—Motor driven controlled volume pumps with instrument air stroke length adjustment detailed in new 4 page bulletin 955. Covers operation of system; includes information on application, features, specifications. Diagrams show major components, show hookup in typical pneumatic flow control system. Milton Roy Co., 1300 E. Mermaid Ln., Philadelphia 18.

▸ *RADIANT HEATING, SNOW MELTING*—New special report covers radiant heating and snow melting for airport installations. Contained in 32 pages are discussion of differences between convective and radiant heating, review of typical installations, analysis of installation data, recommendations for materials, list of cost-governing factors, review of chemical and physical properties of wrought iron. A. M. Byers Co., Clark Bldg., Pittsburgh 22.

▸ *RADIATION DETECTOR*—Bulletin 9320 describes new high speed "Radiamatic" radiation detector said to respond to 98 percent of any temperature change in less than one-half second. Applications, features, specifications given. Minneapolis-Honeywell Regulator Co., Industrial Div., Wayne and Windrim Aves., Philadelphia 44.

▸ *ROOM AIR CONDITIONERS*—Bulletin LP 5.220 is data and sales sheet covering company's "Spotaire LRC" individual room air conditioners designed for room-by-room air conditioning of multiroom structures such as hotels, offices, apartment buildings. Data includes dimensions, nominal capacities for three models in line. Drayer-Hanson, Inc., 3301 Medford St., Los Angeles 63.

Webster's New



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DUAL FUEL BURNER

The Webster Cyclonetic* represents another step in the continuous effort of the Webster Engineering Company to provide the industry with carefully designed and tested combustion equipment, capable of satisfying the requirements of those who demand the ultimate in quality and service.

The development of the Cyclonetic* introduces a unique method of accomplishing flame retention and stability of a gas flame in a gun-type burner with no sacrifice of efficiency or safety when firing either gas or oil.

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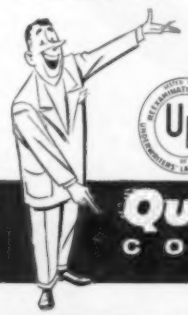

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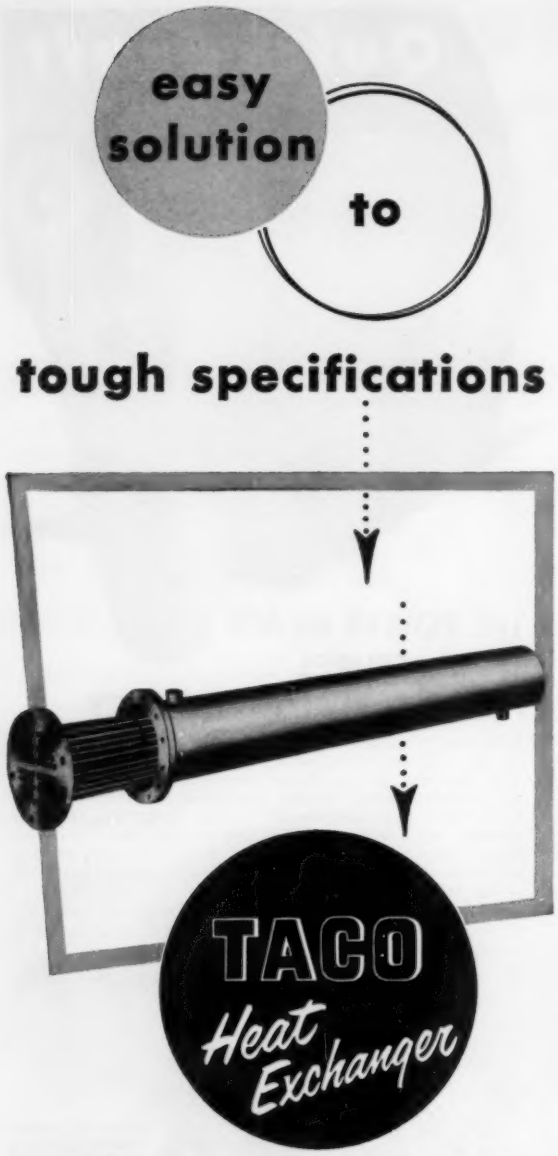

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RECENT TRADE LITERATURE

Continued

▸ *RUBBER HOSE*—Specifications, descriptions of 68 different rubber hose for industrial, agricultural use presented in new 8 page catalog digest. Several of hose types described are recent additions to company's line. Brochure also contains data on conveyor belts, flat power transmission belting, v belts, chute lining, rubber sheet packing, industrial friction materials. Thermoid Co., Industrial Rubber Div., Trenton, N.J.

▸ *SEAMLESS WELDING FITTINGS*—New 6 page data folder gives specifications, illustrations of seamless welding alloys, carbon, stainless steel fittings and flanges. Babcock & Wilcox Co., Tubular Products Div., Beaver Falls, Pa.

▸ *SOLDERING, FLUXES*—New 2 page bulletin explains various types of soldering and action of various types of fluxes. Suggestions for successful soldering given, together with recommendations for selection of fluxes and their proper application. Pfanstiehl Laboratories, Inc., 104 Lake View, Waukegan, Ill.

▸ *SOLENOID VALVES*—Form No. V5004 covers company's new general purpose, two-way solenoid valves designed for minimum maintenance, to be corrosion-resistant, have extra long life, have no damaging water hammer. In sizes 1¼ to 3 in. Automatic Switch Co., 391 Lakeside Ave., Orange, N.J.

▸ *STORAGE WATER HEATER*—Prepared for restaurant operators, form 981 sets forth advantages of company's "Sanimaster" storage water heater in providing hot water for automatic dishwashers. Literature points out that heater delivers full flow rate at 180 F for rinsing, 140 F for general use. Ruud Mfg. Co., Kalamazoo, Mich.

▸ *STUD DRIVER*—Recent number of company's periodical, *Remington Industrial News*, details new "Model 455" stud driver with ½ or ⅜ in. interchangeable barrels, designed to drive to six fastenings per minute with one or two handed operation. Remington Arms Co., Industrial Sales Div., Bridgeport, Conn.

▸ *SUN SCREENING*—New 4 page bulletin describes, illustrates, diagrams, lists advantages for company's low shadow angle "KoolShade Sunscreen." Screening designed to protect windows against build-up of excessive solar heat, glare. Reflectal Corp., 310 S. Michigan Ave., Chicago 4.

▸ *TEMPERATURE MEASUREMENT—How Temperatures are Measured* is 8 page booklet covering heating

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AIR CONDITIONING UNITS

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Use your present heating system for low cost Year-around Air Conditioning without costly duct work and extensive alterations

For
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and other large installations.

Now air condition large buildings without the expense and extensive alterations involved in installing bulky, costly duct work. Fedders new remote-type cabinet air conditioning units cool . . . heat . . . ventilate . . . circulate . . . filter . . . dehumidify . . . with circulating water from your present heating plant, supplemented with a central cooling unit.

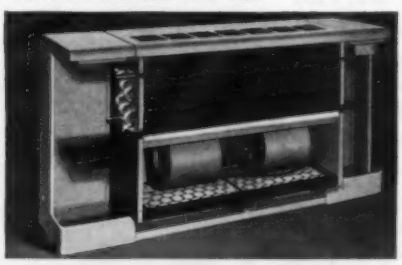
Simple controls permit individual adjustment for each location.

Heat transfer coil, blowers, motor, filter and inlet air damper are housed in a beautifully styled cabinet.

Inlet in rear of Fedair cabinets and adjustable damper provide for introduction of outside air as desired.

Quiet, multi-speed centrifugal blowers give full range of heating and cooling capacities with efficient dehumidification while cooling at low speed.

Fedair remote cabinet units are available in three capacities for standard and fully recessed installations. Write for Bulletin HC-C2.



Cover removed showing arrangement of heating and cooling coil, drain pan, blowers, filter and fresh air damper control.

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MODEL B PUMPS

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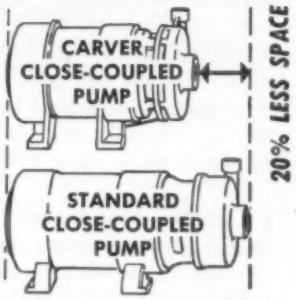

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When we say close-coupled we really mean close-coupled. The illustrations dramatically tell the story.

Mounted on the sturdy, short shafts of close-coupled motors these highly efficient Carver Model B Pumps are stronger, quieter in operation, more attractive . . . better in every way for every job.

And extremely important, of course, is the extraordinary compactness which makes them ideal where space is limited.

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The quality name in pumps

RECENT TRADE LITERATURE

Continued

and temperature as separate concepts, history of commonly used scales for measuring temperature, physical effects associated with rise in temperature and how thermometers and pyrometers use some of these effects, monitoring surface temperature by means of changes in color or physical state. Tempil Corp., 132 W. 22nd St., New York 11.

▸ *THERMAL LIQUID HEATERS*—Selection, efficient use of mineral oils for process temperatures to 600 F explained in new bulletin. Advantages of company's "LaMont" principle of forced recirculation incorporated in its thermal liquid heaters described as they apply to mineral oils. International Boiler Works Co., 540 Plum St., East Stroudsburg, Pa.

▸ *TUBING*—New 4 page bulletin presents table of cutting length tolerances, physical hardness properties of company's lathe cut; punch, saw or disc cut; as-welded tubing. Nikoh Tube Co., 5000 S. Whipple St., Chicago 32.

▸ *TUBING WEIGHT TABLES*—Literature from manufacturer contains table giving pound weight per lineal foot for tubing 3/8 to 4 in. ID. Covers gages 22 to 3. Nikoh Tube Co., 5000 S. Whipple St., Chicago 32.

▸ *UNIVERSAL CENTRIFUGAL PUMPS*—New 4 page bulletin No. HC-855 features company's line of universal centrifugal pumps designed especially for large circulated water systems where smooth, silent operation required. Cutaway drawing details component parts. Capacity chart shows deliveries in gpm according to head in feet of water. Table gives sizes, dimensions of pumps in complete line. How pump can be used for boosting city water pressures in tall buildings also discussed. Bell & Gossett Co., Morton Grove, Ill.

▸ *VARIABLE SPEED TRANSMISSIONS*—"Speed-Trol" variable speed transmissions discussed in new 8 page bulletin. Details inner workings of positive pulley design. Features information on factors in drive selection, description of types of automatic and remote speed control accessories. Sterling Electric Motors, Inc., 5401 Telegraph Rd., Los Angeles 22.

▸ *VIBRATION MOUNTINGS*—New line of vibration mountings for medium to heavy weight machinery described in catalog FP-55. "Finnflex Floating Pillow" mountings are said to offer greater vibration, shock, overload control. Catalog gives detailed description of construction. T.R. Finn Co., Industrial Div., 200 Central Ave., Hawthorne, N.J. ≠

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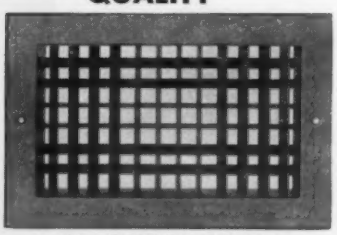

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Large, easy-to-read vertical scale gives tank contents at a glance. Scales are easily changed for different liquids.

Easy to install—the tank assembly for the gauge can be installed when the tank is empty or when containing liquid. It can also be installed separately to complete the tank work. The gauge can be connected any time later. Only one simple connection to tighten.

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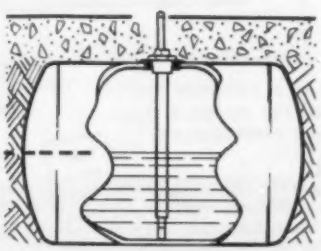

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only gas unit heating offers *all* these advantages

- **COMPLETE ADAPTABILITY TO FUTURE CONSTRUCTION** — internal remodeling or added space can easily be accomodated by merely shifting or adding a few units.
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- **LOW INITIAL COST** because the cost of the heater is the entire equipment cost — no piping or ducts, radiators or registers to buy.
- **SAVING ON VALUABLE FLOOR SPACE** — suspended units occupy no space which could be used for any other purpose.
- **EXTRA HEAT FOR TROUBLE SPOTS** such as areas facing large doors.

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- RESTAURANTS
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One out of every two gas unit heaters sold today is a Reznor. There are two reasons for this domination: "years-ahead" engineering and quality workmanship. An alert, aggressive product development program keeps Reznor ahead of the field in the introduction of improvements for greater heating efficiency, economy and comfort. High standards of craftsmanship and the use of only the finest materials and components insures for Reznor customers the full benefit of this engineering leadership.

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COMPANY.....

STREET.....

CITY..... ZONE..... STATE.....

WHO'S WHAT...

(New personnel, promotions)

▸ *AIR CONDITIONING AND REFRIGERATION INSTITUTE*—Joe H. Bergheim, technical secretary. He will serve as coordinator of the Institute's engineering and standards committees.

▸ *HYDROTHERM, INC.*—Joseph W. Adams, chief engineer. He has served on the appliance service committee of the New England Gas and Electric Association.

▸ *TRANE CO.*—John D. Cantwell, Jr., works manager; John J. O'Brien, general superintendent.

▸ *H. B. SMITH CO., INC.*—Lauren E. Seeley, to devote his full time to the company. Mr. Seeley was elected vice president in charge of engineering in June, but was serving as dean of the school of technology at University of New Hampshire prior to joining the company on a full time basis.

▸ *WORTHINGTON CORP.*—John E. Lancaster, manager of engineering for company's air conditioning and refrigeration division; F. A. MacConnell, chief engineer for division's heavy machinery section.

▸ *BUFFALO FORGE CO.*—William R. Heath, executive vice president; George P. Schivley, director of manufacturing. Mr. Heath was formerly vice president in charge of manufacturing.

▸ *DE LAVAL STEAM TURBINE CO.*—Samuel P. Felix, vice president of De Laval Turbine Pacific Co., the company's wholly owned subsidiary. Mr. Felix' former post was general manager and he will continue to serve in that capacity.

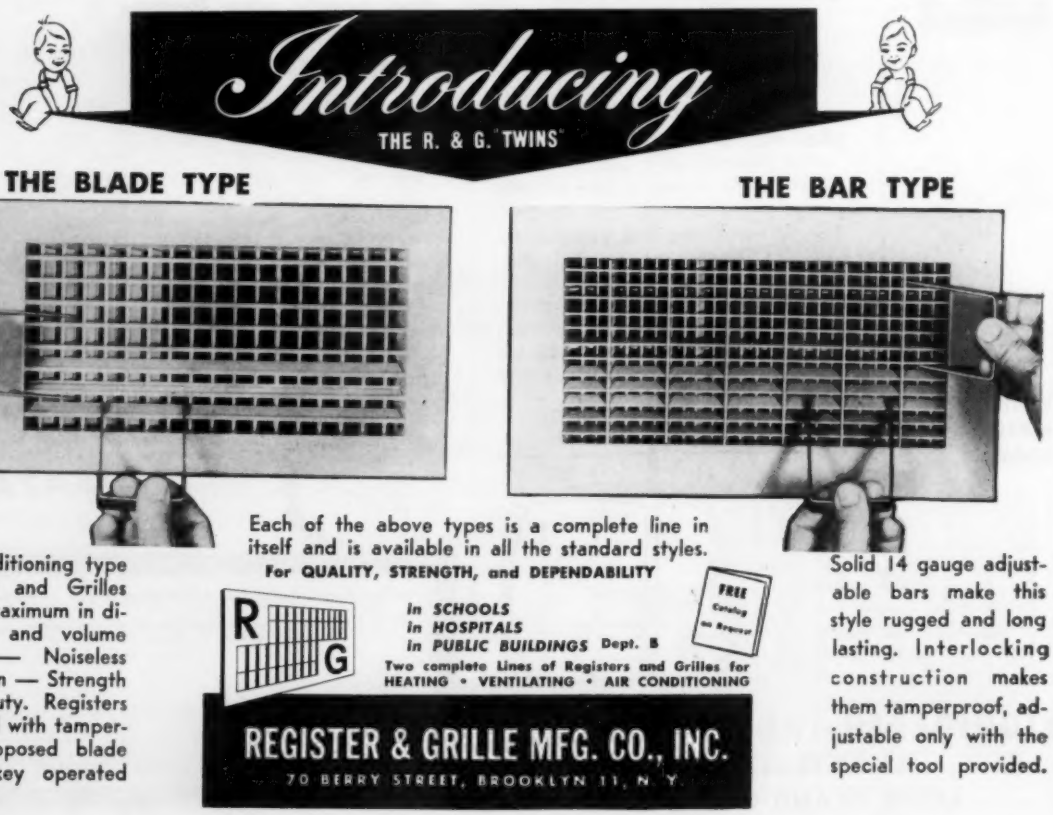
▸ *OWENS CORNING FIBERGLAS CORP.*—G. R. Munger, assistant to T. S. Rogers, technical consultant.

▸ *PERMUTIT CO.*—Richard A. Ogden, secretary. Mr. Ogden already holds the posts of treasurer and assistant to the president.

▸ *INSTITUTE OF BOILER AND RADIATOR MFRS.*—Ray Schumack, appointed to the public relations staff.

▸ *LONERGAN MFG. DIV., McGRAW ELECTRIC CO.*—Rowland B. Greenway, product sales manager for the "Coolerator" air conditioning line.

▸ *PHILCO CORP.*—Franklin L. White, manager of the air conditioning division.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In PUBLIC BUILDINGS Dept. B
FREE Catalog on Request
Two complete Lines of Registers and Grilles for HEATING • VENTILATING • AIR CONDITIONING
REGISTER & GRILLE MFG. CO., INC.
70 BERRY STREET, BROOKLYN 11, N. Y.
Air Conditioning type Registers and Grilles for the maximum in directional and volume control — Noiseless Operation — Strength and Beauty. Registers equipped with tamperproof opposed blade action, key operated shutters.
Solid 14 gauge adjustable bars make this style rugged and long lasting. Interlocking construction makes them tamperproof, adjustable only with the special tool provided.

NEW Ramset®

EXCLUSIVE

DUO-JOBMASTER

INTERCHANGEABLE

on the job

Just twist—unscrew; that's all you do!

Here's the answer to maximum versatility in powder-actuated tools—TWO TOOLS IN ONE, with both ¼" and ⅜" barrels, interchangeable on the job. Operator carries with him the tool, extra barrel, fasteners and charges...sets ¼" and ⅜" studs *with the same tool* merely by switching barrels.

Changing barrels is simplicity itself... just release with a wrench, then a twist of the wrist takes out one barrel and puts in the other. Barrel not much bigger than a fountain pen.

This is the time-proved, job-proved RAMSET® JOBMASTER with this new added convenience. Still FIRST in powder-actuated fastening—imitated but never equaled.

Write for new catalog which shows complete line of RAMSET fasteners, tools and charges. Sent free.

Ramset Fastening System

WINCHESTER-WESTERN DIVISION
OLIN MATHIESON CHEMICAL CORPORATION
FIRST IN POWDER-ACTUATED FASTENING

12109 BEREA ROAD • CLEVELAND 11, OHIO

Two NEW industrial heaters that mean MORE CONTRACTS for you

Easy to Install
Minimum Servicing
Automatic Operation

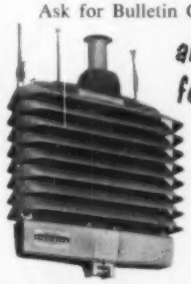
THERMOBLOC

DIRECT-FIRED HEATERS

The ideal warm air heater that heats large open buildings in all directions without ducts. Where necessary to heat individual rooms, THERMOBLOC is easily adaptable to ductwork.

THERMOBLOC is *fully* automatic and can be installed in a matter of hours. Available for either oil or gas. THERMOBLOCS are manufactured in nine models from 100,000 btu to 2,250,000 btu output. This means you can give your customers exactly what they need in heating capacity . . . fast!

Ask for Bulletin GC-4-55.



and "Bring the Sun Indoors" for your customers with...

PANELBLOC

GAS FIRED INFRA-RED UNIT HEATERS

Heats like the sun . . . with gentle, healthful rays. Requires no fan or motor . . . no electrical connections. Installation requires only support from ceiling and hooking up to fuel supply and vent. Unit burns any commercial type gas fuel. You can guarantee customers will keep warm even when power lines are down.

Infra-red rays radiate to the spot you want to heat. PANELBLOC heats only personnel and machines or other objects . . . not air.

Heat is not deflected by draft or wasted in the ceiling. No moving parts mean less maintenance. Available in two sizes, 62,500 btu and 125,000 btu input. Ask for Bulletin P-154.

You can please your customers and make more profits for your company by specifying THERMOBLOCS or PANELBLOCS, depending on the requirements of the installation. Contact Thermobloc Sales today.

THERMOBLOC

Division of

PRAT-DANIEL CORPORATION

5-11 Meadow St. • South Norwalk, Conn.

Prat-Daniel Corp.
5-11 Meadow St.
South Norwalk, Conn.

Gentlemen:

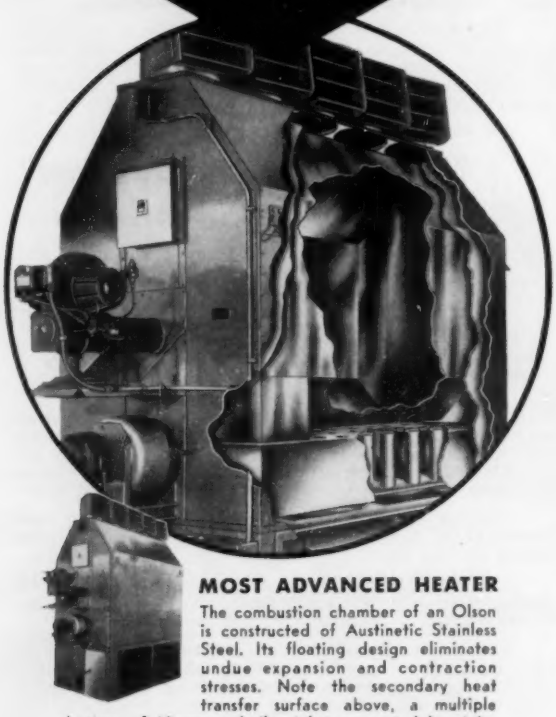
I would like to know more about ☐ THERMOBLOCS ☐ PANELBLOCS

Name_____ Title_____

Company_____

Address_____

STAINLESS STEEL COMBUSTION CHAMBER OF THE OLSON



MOST ADVANCED HEATER

The combustion chamber of an Olson is constructed of Austinetic Stainless Steel. Its floating design eliminates undue expansion and contraction stresses. Note the secondary heat transfer surface above, a multiple battery of 10 guage boiler tubes separated by stainless steel baffles providing a four pass counterflow gas travel. The extended flue gas travel and extra heat transfer surface insures high efficiency and safe metal temperatures and long dependable heater life. Write for complete information on Olson Heaters.

Olson

STAINLESS STEEL DIRECT FIRED HEATERS

Gas—Oil—Dual Gas and Oil—300,000 to 2,000,000 BTU

CANFIELD, OHIO

REPRESENTATIVES IN PRINCIPAL CITIES

WHO'S WHAT — *Continued*

▸ *OHIO STATE UNIVERSITY*—Roy B. McCauley, Jr., chairman of the department of welding engineering. An associate professor, Mr. McCauley joined the university staff in 1950.

▸ *FEDDERS-QUIGAN CORP.*—Edward Becker, sales manager of the refrigeration division. Before this appointment, Mr. Becker was New York district sales manager.

▸ *FRANKLIN INSTITUTE*—Richard Y. Case was awarded the Edward Longstreth Medal of the Franklin Institute. Mr. Case is assistant manager and chief engineer in the power transmission department of the United States Rubber Co.

▸ *CARRIER CORP.*—Andrew C. Freimann, vice president in charge of marketing; R. E. Cassatt, manager of commercial sales; John R. Schreiner, on the staff of the advanced engineering department. Mr. Schreiner is former technical secretary of Air Conditioning and Refrigeration Institute.

▸ *L.O.F GLASS FIBERS CO.*—Dominick Labino, vice president and director of research; William M. Temple, manager of government sales.

▸ *SERVEL, INC.*—William H. Schrader, vice president in charge of finance. He succeeds Rudolph Schnakenburg, who has retired after having been with the company for 35 years. Anthony J. DeFino has been appointed vice president and general manager of the air conditioning division.

▸ *SCOVILL MFG. CO.*—William H. Harris, assistant to the vice president in charge of manufactured sales.

▸ *JOHNS-MANVILLE CORP.*—Thomas H. Eaton, production manager of the industrial insulation division; J. B. Jobe, merchandise manager; and E. D. Flavin, general sales manager. Mr. Eaton is elected vice president of Johns-Manville Products Corp.; Mr. Flavin is named vice president of Johns-Manville Sales Corp.

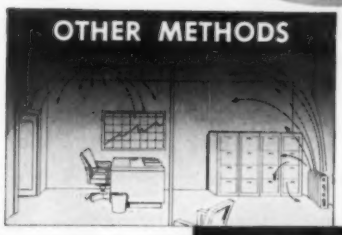
▸ *A-P CONTROLS CORP.*—Arthur W. Krause, chief methods engineer. He will replace Ed Solski, who has been promoted to the position of chief industrial engineer.

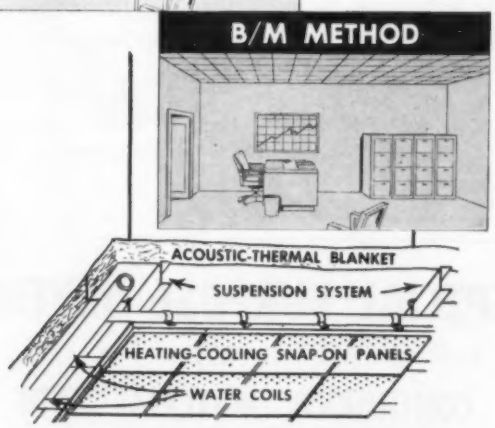
▸ *RHEEM MFG. CO.*—G. M. Greenwood, chief financial officer; Gordon W. Mallatratt, secretary and treasurer; Vearl J. Heinis, general manager of the Rheem Products Div.

Let's face facts...

BURGESS-MANNING
RADIANT PANEL
Heating, Cooling and Acoustic Control

is the modern comfort





The three functions of the Burgess-Manning 3-Way Radiant Panel Functional Ceiling are combined for the first time to provide uniform radiant panel heating or cooling with ideal room acoustics for a new standard of human comfort. This is verified by schools, hospitals, office buildings, laboratories and restaurants of recognition, designed and built by men of vision. The "Radiant Panel" Principle of this most modern ceiling provides constant, uniform heating and cooling independently of air movement. Heat energy is radiated to or from the entire ceiling, to or from every surface or object in the room. Convection drafts and heat shadows are minimized — concentrated heat sources and overheated air are eliminated. The word is getting around and your more discriminating clients will want the facts—do you have them?

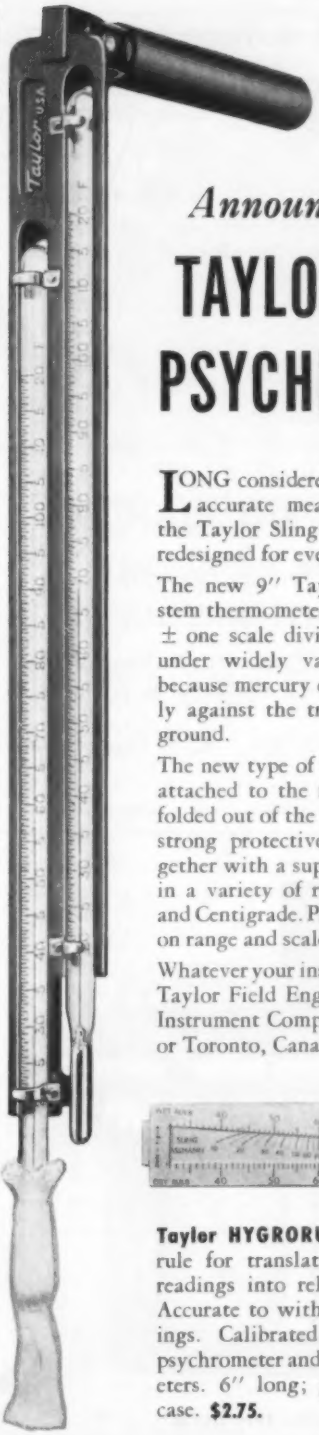
Know the facts – **Write for Bulletin A-129-H**

Architectural Products Division of

BURGESS-MANNING COMPANY

5970 Northwest Highway, Chicago 31, Illinois

Manufacturers of 3-way Functional Ceilings and Acousti-Booths for Telephoning



Announcing a new

TAYLOR SLING PSYCHROMETER

LONG considered the basic standard for accurate measurement of humidity, the Taylor Sling Psychrometer has been redesigned for even simpler operation.

The new 9″ Taylor Gold Back etched stem thermometers are accurate to within ± one scale division. They can be read under widely varying light conditions because mercury columns stand out clearly against the translucent golden background.

The new type of swivel handle is rigidly attached to the metal back, and can be folded out of the way when not in use. A strong protective case is provided, together with a supply of wicks. Available in a variety of ranges, both Fahrenheit and Centigrade. Price **$10** to **$15** depending on range and scale calibration.

Whatever your instrument needs, call your Taylor Field Engineer, or write Taylor Instrument Companies, Rochester, N. Y., or Toronto, Canada.

Taylor HYGRORULE. A convenient slide rule for translating wet and dry bulb readings into relative humidity values. Accurate to within ± 1 % of table readings. Calibrated both sides for sling psychrometer and wall mounting hygrometers. 6″ long; genuine leather pocket case. **$2.75.**

Taylor Instruments
MEAN ACCURACY FIRST

WHO'S WHAT

Continued

▸ *O. A. SUTTON CORP.*—Albert S. Bross, vice president in charge of sales; Floyd M. Kinney, chief motor engineer

▸ *MINNEAPOLIS-HONEYWELL REGULATOR CO.*—C. L. Peterson, vice president and general manager of the Brown Instruments Division. Mr. Peterson has been with the firm for 28 years. A. Lachlan Reed is new director of industry-education relations.

▸ *JOSEPH T. RYERSON & SON, INC.*—Robert A. Daggit, assistant manager of sales for the company's Chicago plant.

▸ *NATIONAL-U.S. RADIATOR CORP.*—C. H. Austin, assistant to the vice president in charge of the company's heating and air conditioning division.

▸ *OWENS-CORNING FIBERGLAS CORP.*—Reeve K. Biggers, national account executive.

▸ *FEDDERS-QUIGAN CORP.*—U. V. Muscio, a vice president. Mr. Muscio was assistant to the president.

▸ *BARRY CONTROLS, INC.*—A. S. Chivers, sales manager.

▸ *MODERN ENGINEERING CO.*—A. J. Fausek, chairman of the board; I. F. Fausek, president; Al. V. Fausek, vice president in charge of sales; Willis L. Reedy, vice president in charge of production; I. F. Fausek, Jr., secretary. A. J. Fausek is founder of the company.

▸ *OLIN MATHIESON CHEMICAL CORP.*—H. F. Devens, sales manager for "Roll Bond," produced by the company's metals division.

▸ *BINKS MFG. CO.*—John E. Rowe, a member of the board of directors. Mr. Rowe is vice president in charge of advertising and industrial relations.

▸ *MUELLER CLIMATROL DIV., WORTHINGTON CORP.*—Don H. Davidson, field sales manager.

▸ *BAYLEY BLOWER CO.*—Frank J. Hamilton, sales manager.

▸ *ALLOY STEEL PRODUCTS CO., INC.*—Raymond M. Davis, president. He succeeds his brother, the late Jack Davis, in that position.

▸ *REFLECTAL CORP.*—Cecil W. Foster, sales and development engineer; A. G. Ricketts, western sales manager.

BATCH TYPE DRYER

SPECIAL PURPOSE DRYERS

CONTINUOUS MATERIAL TYPE

CONVEYOR TYPE

BATCH TYPE

UNIT TYPE

WRITE FOR CATALOG SECTION 70

AIR & REFRIGERATION CORPORATION

439 MADISON AVE. • NEW YORK 22, N. Y. • ATLANTA, GA.

SALES REPRESENTATIVES IN PRINCIPAL CITIES

A&R

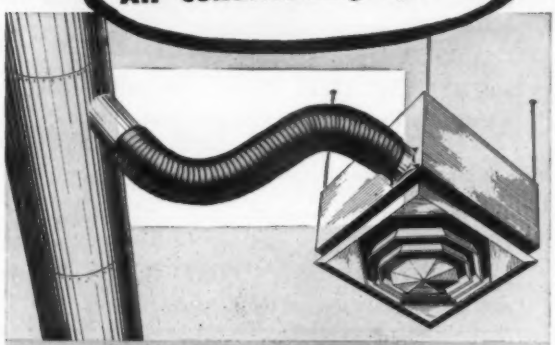
√SPECIFY

WIREMOLD

FLEXIBLE

AIR-DUCT

for Commercial Air Conditioning systems



√EASY to INSTALL!
√SAVES Time and Money!
√ INCREASES Efficiency!

The flexibility and lightness of WIREMOLD Flexible AIR DUCT save time and money on installation. It can be cut to length easily and quickly. All sizes are produced within exact tolerances, assuring a snug fit.

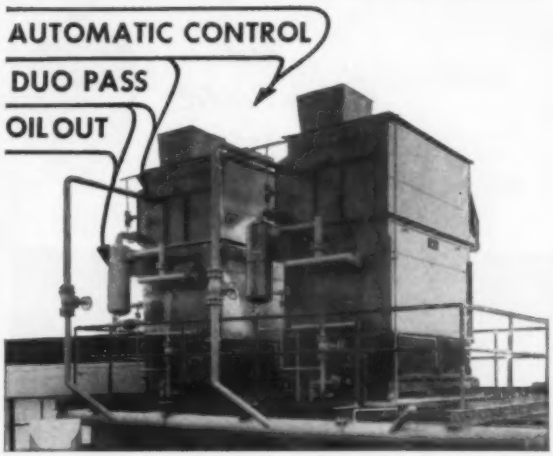
Wiremold's combination of tested materials and exclusive construction assures long life. There is no glue or adhesive to dry out or crack, because a specially coated Fibreglas is *mechanically locked* into the supporting steel spiral.

WIREMOLD AIR DUCT type 571A was developed specifically for flexible connections on high velocity systems. It provides an airtight connection which dampens mechanical vibration and allows for expansion and contraction.

WIREMOLD Flexible AIR DUCT has been tested in the laboratory and proved on the job. It is recommended by leading makers of air distribution equipment.

Get the complete story on WIREMOLD Flexible AIR DUCT. Write for Data Sheet S-3.

The WIREMOLD Company
HARTFORD 10, CONNECTICUT



SAVE HALF THE ENGINEER'S TROUBLES WITH A REFRIGERATION PLANT

Hundreds of engineers have been interviewed about their experience with the Niagara Aeropass Condenser. In one way or another, they say, "I wouldn't go back to anything else." And their managers, who watch costs, say, "Best investment we ever made, couldn't operate now, without it."

Niagara Aeropass Condensers have three exclusive features which save trouble and money in running a refrigeration plant:

"The Duo-Pass"— keeps scale and salts from crusting the coils, keeps the condenser always at full capacity.

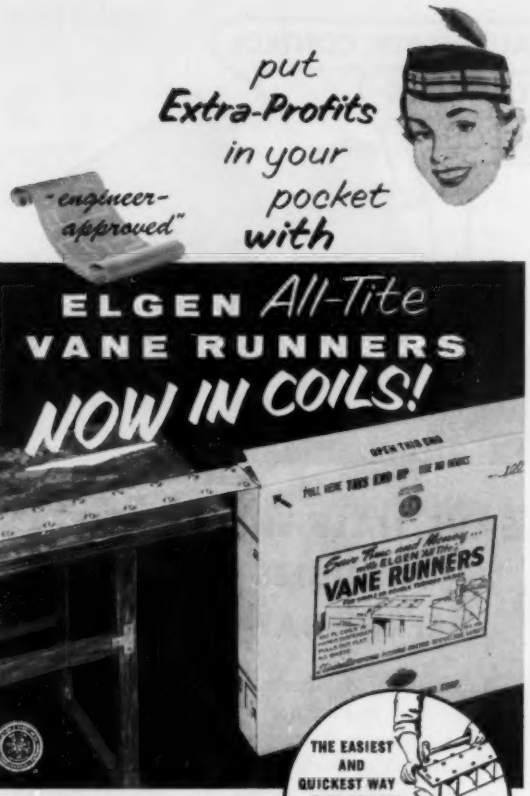
The "Oilout"— removes oil and dirt from the refrigerant, at the exact point where the oil vapor is condensed and the refrigerant is not.

The "Balanced-Wet-Bulb" control gives automatic operation at the minimum head pressure, saving power cost the year 'round!

In addition, the Niagara Aeropass Condenser saves nearly all your cost of cooling water, quickly bringing back to you the cost of installation. In plants where refrigeration is a production process, owners know that this condenser has reduced their costs.

Write for Bulletin 103; Address Dept. HP
You can see one of these installations near you.

NIAGARA BLOWER COMPANY
405 Lexington Ave. New York 17, N. Y.
District Engineers in Principal Cities of United States and Canada



New production machinery of our own exclusive design, now enables us to produce button type Elgen All-Tite vane runners in continuous coils, effecting a savings in your cost per job.

COILED ELGEN ALL-TITE VANE RUNNERS MEANS . . .

- *Less Waste!* Waste pieces due to short ends are a thing of the past. Vane runner metal is coiled in 100 foot lengths, you just pull out the exact footage needed.
- *Easier Storage!* Each coil weighs approximately 50 lbs. and is packed in a box 28" x 28" x 5". Box fits easily under bench or against wall.
- *Easier Handling!* No loose pieces lying around to get in the way or collect dirt.
- *Unrolls absolutely flat!* Vane runner metal emerges from the box at bench height . . . absolutely flat . . . ready for use.

TWO MORE ENGINEER-APPROVED ELGEN PRODUCTS THAT SAVE YOU TIME AND MONEY

ELGEN SILENT DUCT

. . . for forming "flexible" duct connectors. A one piece metal to material unit, packed in coils, unrolls absolutely flat. Makes on the spot work a cinch.

ELGEN DAMPERSET

. . . for multi-blade dampers, parallel or opposed. Most perfect damper hardware developed.

ELGEN PRODUCTS ARE SOLD THROUGH LEADING JOBBERS EVERYWHERE.

Write today for free catalog and "spec" sheet!

ELGEN MANUFACTURING CORP.

41-34 39th Street, Long Island City 4, N. Y. Dept. E-11

WHO'S WHAT

Continued

▸ *WORTHINGTON CORP.*—William F. Bishop, manager of national account sales; Robert C. Hughes, manager of sales training.

▸ *BLACK & DECKER MFG. CO.*—Albert S. Fehsenfeld, head of wholesale division; Arthur L. Boehm, head of industrial-automotive division.

▸ *HENRY VALVE CO.*—Paul G. Kollberg, field engineer.

▸ *COPELAND REFRIGERATION CORP.*—Glennon J. Doyle, vice president in charge of operations.

▸ *ARMSTRONG FURNACE CO.*—Dan J. Calori, assistant sales promotion manager.

▸ *WHEELING STEEL CORP.*—Alexander Shearer, assistant to the operating vice president.

▸ *BUXTON MFG. CO.*—Robert B. Meacham, vice president and sales manager.

▸ *GENERAL DYNAMICS CORP.*—John F. Thurston, general manager of the Electro Dynamic Div.

Use *Stic-Klip*® for

Insulation Installation

ON AIR CONDITIONING AND VENTILATING SYSTEMS FOR COLD STORAGE PLANTS, BUILDINGS AND SHIPS.

1 TYPE B with Locking Plate
2 TYPE B
3 TYPE A
4 TYPE S ADHESIVE
5 SPRING TUBING CLIP (¼" and ⅜")
6 HOLDING PLATE used with Type A and B
7 TYPE H with Speed Washer
8 INSERT BASE Securing Signs, Wall Cabinets, etc.

Stic-Klips permanently bind almost any insulating material to masonry, wood, metal — flat, corrugated, curved, unusual-shaped. This modern method eliminates drilling, puncturing metal — saves time and money.

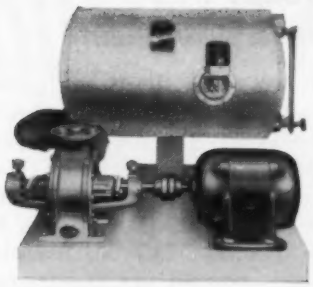
For illustrated booklet on any of these applications, write Dept. HP

Stic-Klip MANUFACTURING CO.

50 Regent St., Cambridge 40, Mass.

Entrust ALL of Your CONDENSATE RETURN JOBS to AURORA with complete confidence

These Horizontal



APCO
CONDENSATE RETURN UNITS

•

Simplex and Duplex

•

RATED
Sq. Ft. Equivalent Direct Radiation
2,000 to 100,000

insure a high standard of service

Thousands of these units — simplex and duplex are in the service of practically every industry, winning engineer favor through excellent performance. They are designed for the automatic return to low and high pressure boilers of the hot water condensation from radiators, coils etc. Horizontal units are used where the returns are above the boiler from floor level.

★

APCO Handles Hot Water Perfectly — Will Not Vapor Bind or Lock.

★

Free Running Clearance Allows for Expansion Due to Heat.

★

SIMPLE, EFFICIENT, TROUBLE-FREE, LASTING

★

Replaceable Pump Covers an Economy

ALSO *we offer--*

AURORA Vertical Simplex Condensate Return Units — For under floor level return — 2,000 to 100,000 sq. ft. E. D. R. (Available in Duplex).

• • •

Vertical APCO-MATIC Simplex Condensate Return Units — Close to Floor Return — 800 to 10,000 sq. ft. E. D. R. (Available in Duplex).

• • •

APCO Packaged Square Tank Condensate Return Units. Handles to 15,000 sq. ft. E. D. R. against pressures up to 40 pounds. (Available in Duplex).

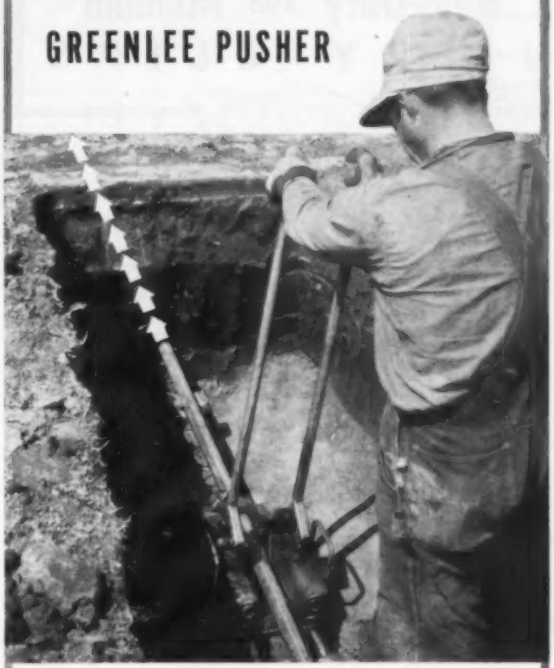
Rely upon Aurora Know-How and Aurora's exclusive attention to the manufacture of quality pumps for the VALUE you seek and your customer appreciates.

Complete Information on Request

DISTRIBUTORS IN PRINCIPAL CITIES

AURORA® PUMP DIVISION
THE NEW YORK AIR BRAKE COMPANY
80 LOUCKS STREET • AURORA • ILLINOIS

CUT COSTS ON UNDERGROUND PIPING INSTALLATIONS WITH GREENLEE PUSHER



Save hours of time, cut job costs with this quick, easy way of installing underground pipe. With a GREENLEE Hydraulic Pipe Pusher, *one man* pushes pipe *under* streets, walks, tracks, lawns, floors, and other obstacles. No costly tearing up of paving . . . eliminates extensive ditching, as just a short trench accommodates the Pusher. No tedious tunneling, backfilling, tamping, repaving. Compact, portable, powerful. Often pays for itself on first few jobs. Thousands in use for big savings of time and labor. Two models: one for ¾ to 4" pipe, one for larger pipe, concrete sewer pipe, drainage ducts. Write for facts today.

POWER PUMP

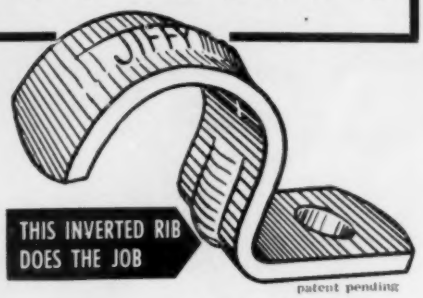
For all models of GREENLEE Pipe Pushers and Hydraulic Pipe Benders. Makes the toughest pushing jobs simple, fast. Average pushing performance: two feet per minute. Rubber-wheeled undercarriage, available as extra equipment, provides convenient, easy way to transport and move about on job location.

TOOLS FOR CRAFTSMEN
GREENLEE

Greenlee timesaving tools for plumbing and heating work: Hydraulic Pipe Pushers • Hydraulic Pipe Benders • Tubing Benders • Pipe Bits Auger Bits • Spiral Screw Drivers • Chisels • And many more Greenlee Tool Co., 2351 Twelfth Street, Rockford, Illinois

Two New Mineralac Quality Products Designed
for Jobs Too Heavy for Standard Jiffy Clips

MINERALLAC
Hevi-Duty AND Medium
JIFFY CLIPS



Available without mounting hole for use with gun.

patent pending

Made of heavier material! Has exclusive inverted rib, that provides more strength at the bend of clip . . . and, of course, adds the benefits of famous "Snap On" feature!

In stock in Zinc-Plated Steel up to 6".
Thin Wall or Rigid Conduit. (Hot Dipped Galvanized may be obtained on order) Can be substituted for malleable clips.

Order From Your Electrical Wholesaler
SEND FOR LITERATURE
MINERALLIC ELECTRIC CO., 25 No. Peoria St., Chicago 7, Ill.
MINERALLAC

WHO'S WHAT

Continued

▸ *TRANE CO.*—John B. Custer, appointed to the unit heat transfer department.

▸ *J. A. ZURN MFG. CO.*—John Patrick Tansey, manager of engineering sales for the company's industrial and marine division.

IN THE TERRITORIES . . .

(Recent sales appointments)

▸ *YORK-SHIPLEY, INC.*—Russ B. Jenner, factory regional manager for New England. Representatives to serve under Mr. Jenner are: James W. Vanderpool, for Maine; A. C. Bailey, for Vermont; John K. MacLean, for Rhode Island, southern Massachusetts; Arthur Durgin, for Massachusetts, E. A. Seeley, for New Hampshire, Massachusetts. Industrial specialists for New England, also under Mr. Jenner's direction are: Garment Machinery Co. for the laundry trade, D'Orsay Equipment Co. for the dairy trade.

▸ *SERVEL, INC.*—Servair Heating & Cooling Corp. and W. V. Alton Sheet Metal Co., distributors for air conditioning products in Indianapolis and Marysville, Calif. areas, respectively.

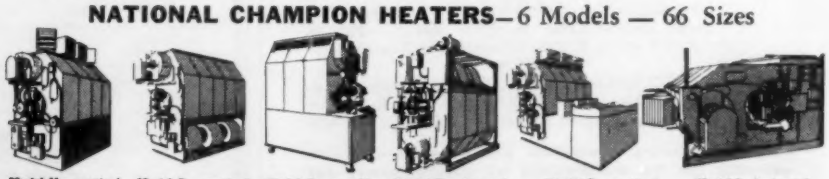
National Champion
CARRIES THE BALL FOR YOU!

Heating problems got you blocked? Let National Champion Heaters "score the TD." Whatever your heating need—space heating, tempering, make-up air, curing, drying or de-icing—there's a National Champion to do the job. Check these winning points:

- 80% guaranteed heating efficiency
- Direct fired for gas, oil or combination fuels
- Completely automatic controls — for constant, clean heat
- 70%-150% more heat transfer area than similar units
- Quieter, smoother operation — lowest blower RPM
- Highest available external static pressures
- Electronic flame failure control
- Completely wired, assembled and flame-tested at the factory to guarantee peak performance
- Listing by Underwriters' Laboratories, Inc.

Teardrop design Combustion Chamber the "heart" of National Champions

NATIONAL CHAMPION HEATERS—6 Models — 66 Sizes



Model H—vertical unit with discharge heads. 12 sizes.
Model D—vertical unit for duct work. 12 sizes.
Model P—portable, vertical unit for flexible duty. 6 sizes.
Model R—inverted unit with discharge heads at bottom. 12 sizes.
Model S—vertical unit with side blowers to permit proper location of air mixing dampers. 12 sizes.
Model C—horizontal ceiling suspension unit for space saving. 12 sizes.

200,000 to 2,000,000 BTU CAPACITIES

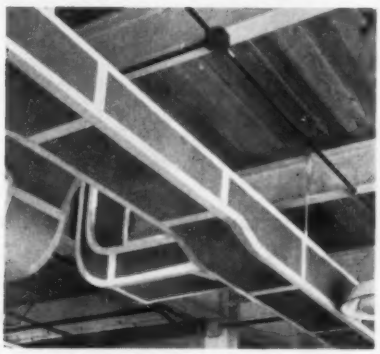
Write today for complete information and specifications.

NATIONAL HEATER COMPANY, INC.
2180 Cleora Avenue, St. Paul 4, Minnesota

COSTS MORE and WORTH IT!

Grant Wilson DUX-SULATION

ASBESTOS PROTECTED



Despite the advent of many lower priced insulations, many of the nation's leading architects and engineers continue to specify Grant Wilson Dux-Sulation. One reason is that Dux-Sulation is just about indestructible — can't possibly be crushed or cracked. Its insulation and sound absorption efficiency, high to start with, *cannot* be impaired during installation.

Dux-Sulation can't powder, shift or sift. There are no "thin" spots, even at corners. There is no deterioration of any kind, no change of any kind. Insulating values are constant, indefinitely!

Special adhesive and tape (supplied) obviate the need for any additional "fasteners". If desired, Dux-Sulation can be applied in the shop and still withstand all necessary handling. On all counts, especially on projects where nothing less than the best is acceptable, Dux-Sulation is still your logical choice — the insulation you can specify with *absolute confidence* . . . no ifs, ands or buts!

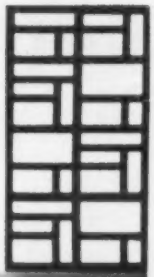
write for Bulletin 567H-11

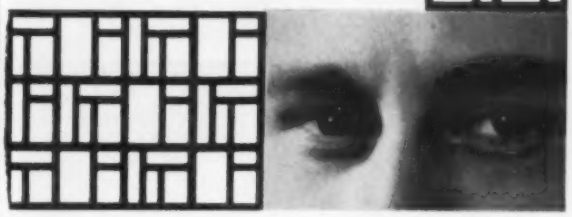
Grant Wilson inc.

ASBESTOS and INSULATING MATERIALS

141 WEST JACKSON BLVD. • CHICAGO 4, ILLINOIS

Grilles





for that distinctive look

Just as eye-appealing as they are functional, Hendrick Perforated Metal Grilles will greatly enhance the beauty of your decorative motif.

They provide more-than-ample open area for the free passage of air, and are available in a wide variety of designs to best set off your decor. And they're easy to install because of a special flattening operation in their manufacture.

Over one hundred basic designs are available to choose from — many are obtainable only from Hendrick. Hendrick will gladly cooperate with architects to help select from a wide range of standard and special designs. For more complete details write Hendrick today!

Hendrick

MANUFACTURING COMPANY

48 DUNDAFF ST., CARBONDALE, PA. • *Sales Offices in Principal Cities*

Perforated Metal • Perforated Metal Screens • Wedge-Slot Screens • Architectural Grilles • Mitco Open Steel Flooring • Shur-Site Treads • Armorgrids

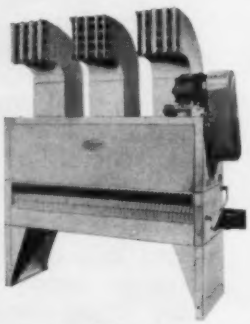
Carrier knows heating

Over fifty years of leadership in air conditioning have given Carrier unmatched experience in the control of temperature—heating as well as cooling. Yes, Carrier knows heating by experience—and all this engineering skill and leadership contributes to the superiority of Carrier Unit Heaters.

Heat Diffuser used to "Air Blanket" Door Openings

This compact, versatile unit "blankets" door openings with a wall of warm air. Unique down-flow, warm-air outlet can be installed to extend across the top of the door. A full-width air blanket blasts warm air all the way to the floor. Unit can be thermostatically controlled to operate only while door is open. It keeps cold out, prevents drafts and saves fuel. It is ideal for open shipping doors. Sectionalized construction makes installation easy.

Carrier Heat Diffusers can be used for many other applications, industrial or commercial. They distribute heat evenly at full or partial loads. Positive control of heat saves fuel through flow control of steam or hot water, or damper control of air. Sectionalized construction permits floor mounting, vertical or horizontal suspension. Sizes and arrangements for 80,000 to 1,620,000 Btu/hr; 1500 to 31,000 cfm.



WRITE or USE COUPON for complete information

Carrier

air conditioning
refrigeration
industrial heating

CARRIER CORPORATION, 305 S. Geddes St., Syracuse, New York
Please send folders on features and selection data for Carrier Heating and Ventilating Units and Heat Diffusers.

Name_____

Business_____

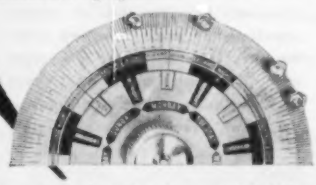
Address_____

Cut customer fuel bills 7 days a week

it's good business to always install a PARAGON 700 Series Calendar Time Switch on commercial heating units

YES, the good word gets around fast when a Paragon 700 Series Time Switch is on the job cutting heating bills. Heat is *automatically turned off* when not needed. Customer satisfaction through lower fuel bills *plus* fewer service "call backs" are big profit boosters for you! Check these features: :

- **COMPLETELY FLEXIBLE** — completely economical. Switch settings can be made for the entire week's schedule, yet easily and quickly changed. ON-OFF or OFF-ON operation can be as close as 3 hours.
- **FULLY AUTOMATIC** — set it, then forget it. Saves money weekends, for example: switch may be set to cut off heat Saturday noon, then automatically start regular heating cycle earlier than usual Monday.
- **INSTANTLY CHANGEABLE** — simply set the dial trippers at desired day or night hours. Total of 14 are supplied as standard equipment.



Ask for Bulletin HP-5407

See your jobber, or write: Dept. 1811

Dial is graduated in hours and half-hours. Night and day periods clearly separated. Available in 24, 120 and 240 volts; 25, 50 and 60 cycles. No complicated wiring. Lists as low as $28.50.

PARAGON ELECTRIC COMPANY
TWO RIVERS, WISCONSIN
World's Foremost Manufacturer of Time Controls

WHO'S WHAT *Continued*

▸ *U. S. AIR CONDITIONING CORP.*—Technical Products Co., distributor for packaged air conditioning equipment in Austin, Texas area.

▸ *AIRTEMP DIV., CHRYSLER CORP.*—Amiel B. Caramanna, district manager attached to New York regional office; Edward D. Farrell, St. Louis room air conditioner district manager.

▸ *WESTINGHOUSE ELECTRIC CORP.*—Donald W. Davis, Jr., midwestern regional manager for the sturtevant division; Forslund Pump and Machinery Corp., distributor for ventilating sets, general purpose industrial fans in western Missouri, Kansas, also for the sturtevant division.

▸ *D. J. MURRAY MFG. CO.*—Triangle Equipment Co., Inc., distributor for unit heaters in northern Illinois, northwestern Indiana.

▸ *WORTHINGTON CORP.*—Ralph G. Griffin, manager of Cincinnati district office.

▸ *L.O.F GLASS FIBERS CO.*—Ralph G. Cox, sales manager for southeastern region; Edward A. McCabe, district sales manager of New York area; Francis W. McPeek, district sales manager of Cincinnati area; William R. Browne, field representative in New York; John A. Webb, field representative in Philadelphia; Randolph H. Barnard, Jr., representative in Charlotte office; Don McAnally, sales promotion manager for the company.

▸ *DRAYER-HANSON, INC.*—Lloyd Backstrom & Co., representative for the Pacific Northwest, covering Washington, Oregon.

▸ *A.W. CASH CO.*—New agents and the territories they will cover are: I.W. Cotton Co., central and southern Indiana; Fuel Economy Engineering Co., Minnesota, the Dakotas, northwest Wisconsin; Keener Sales Co., eastern Tennessee.

▸ *COPELAND REFRIGERATING CORP.*—Terrell J. Small, district sales representative for Texas, Oklahoma.

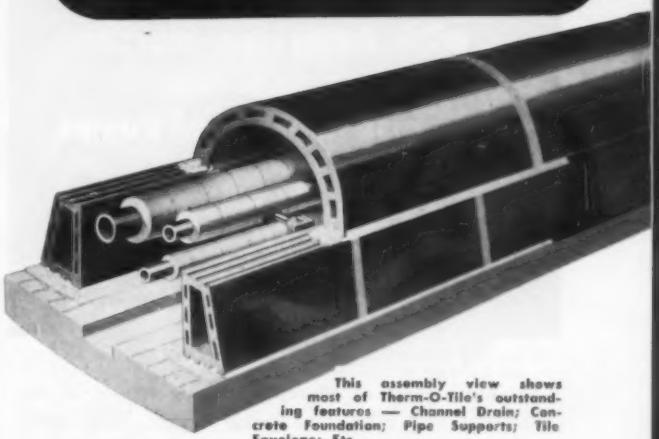
▸ *FIELD CONTROL DIV.*—C.L. Boyer & Co., representative for the Montana area.

▸ *TRANE CO.*—Joseph Wait, appointed to Washington, D. C. sales office.

Therm-O-Tile

CONDUIT FOR UNDERGROUND PIPING

• PERMANENT • ECONOMICAL
• SIMPLE • EFFICIENT



This assembly view shows most of Therm-O-Tile's outstanding features — Channel Drain; Concrete Foundation; Pipe Supports; Tile Envelope; Etc.

FILL IN THIS COUPON

CLIP OUT AND MAIL TO US.

Therm-O-Tile engineers and representatives will quickly and gladly cooperate with you.

H. W. Porter & Co., Inc.,
822-H Frelinghuysen Ave., Newark 5, N.J.

Without obligating us in any way.

☐ Please send your new Bulletin No. 10154

☐ Send representative.

☐ Enclosed is a sketch, with principal data of a prospective job, on which we shall be glad to have your ☐ comments, ☐ quotations.

Name .....

Firm .....

Street .....

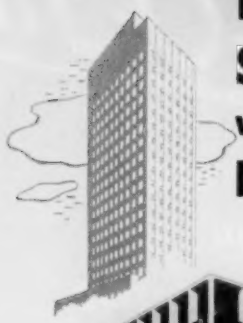
City ..... State .....

H. W. PORTER & CO., INC.
822-H Frelinghuysen Avenue • Newark 5, N. J.

REID HAYDEN, INC.
BALTIMORE, MD. RICHMOND, VA. CHARLOTTE, N. C.

Insulation Engineers & Contractors

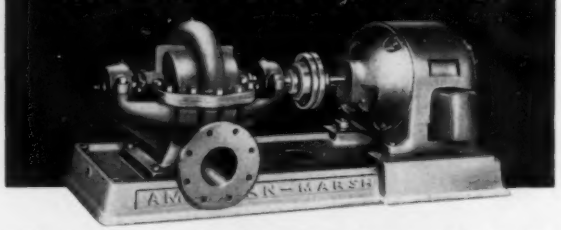
Handle HIGH STATIC HEADS with greatest EFFICIENCY!



— in skyscrapers or buildings like this —

LOUIS CHECKMAN PHOTO

with American-Marsh TYPE HLM-HIM Split-case Centrifugal Pumps



To insure years of efficient pumping service in the beautiful new NEA Educational Center, Washington architects *Joseph H. Saunders, A.I.A.,* selected *four* Type HLM-HIM American-Marsh Pumps.

In skyscrapers too, they're often installed because they're *properly designed and built* to handle *extremely high static heads.*

Such quality features as purge-type grease lubrication, heavy-section casings and extra-deep stuffing boxes recommend them to you. But get *all* the details . . .

WRITE for new HLM-HIM Bulletin 350 with cutaway views and performance data!

Pumps and Pumps only Since 1873

AMERICAN-MARSH PUMPS

BATTLE CREEK MICHIGAN

In Canada:
American-Marsh Pumps (Canada) Ltd., Stratford, Ont.

CENTRIFUGAL, TURBINE, STEAM AND POWER PUMPS FOR TESTING, PROCESSING, BOILER FEED, FIRE PROTECTION, ETC

WHO'S WHAT *Continued*

▸ *OLIN MATHIESON CHEMICAL CORP.*—J. A. Lindberg, regional sales manager for brass products in the northern Ohio-Michigan region for the metals division; Peter L. Brett, to Detroit district as sales representative, also for the metals division.

▸ *WOLVERINE TUBE, DIV. OF CALUMET & HECLA, INC.*—William M. Robertson, sales representative in New York.

▸ *YOUNG RADIATOR CO.*—John J. Sidwell, sales manager for new district office at Chicago.

▸ *MULTI-VENT DIV., PYLE-NATIONAL CO.*—New regional sales managers and their offices are: Herbert L. Cushman, Atlanta; Albert Land, Jr., Houston; Jack M. Johnsen, New York; William E. Hill, Los Angeles; Jay Smith, Chicago.

▸ *KRITZER RADIANT COILS, INC.*—Canadian sales representatives are: M. A. Stewart & Sons, Ltd., for British Columbia; J. R. Stephenson, Ltd., for Alberta, Saskatchewan, Manitoba; Glenco Products, for Ontario, Quebec; H. Avard Loomer & Co., for New Brunswick, Newfoundland, the Maritime Provinces.

▸ *ALLIS-CHALMERS MFG. CO.*—V. L. Spinney, manager of company's central region; N.W. Landis, manager of New York district, succeeding Mr. Spinney; A.J. Mestier, Jr., manager at Detroit, succeeding Mr. Landis; John W. Becker, manager of Syracuse district.

▸ *AMERICAN BLOWER CORP.*—J. A. Gilman, southern division merchandise manager, to service jobbers in Florida, Georgia, Alabama, Tennessee.

▸ *FIELD CONTROL DIV.*—Associated Sales Engineers Co., agent for draft controls in Oklahoma, northern Texas.

▸ *J. F. PRITCHARD AND CO. OF CALIFORNIA*—Richard S. Brent, district sales engineer for the Chicago district office.

▸ *DEMING CO.*—John W. Pritchard, midwestern sales representative covering southern Illinois, western Indiana, central Missouri.

▸ *SERVEL, INC.*—Absorption Cooling & Heating Corp., distributor for air conditioning products in the Chicago trading area.

it's Sterlco® for...

ACCURATE TEMPERATURE CONTROL

Series 150-E Temperature Control Valve

gives you QUALITY CONSTRUCTION

• • • DEPENDABLE PERFORMANCE

at a LOW COST It is a self-actuated, completely automatic modulating control valve — for any heating or cooling application using steam, water, or other heat transfer fluids. Available in ½", ¾", and 1" sizes and for temperatures up to 255 degrees F. . . . and, remember, the Sterlco Series 150-E . . .

MOUNTS AND OPERATES IN ANY POSITION

UPSIDE DOWN | AT ANY ANGLE | HORIZONTAL | UPRIGHT

Sterlco® THERMOTROL

- RUGGED
- DEPENDABLE
- AUTOMATIC

Individual Radiator Temperature Control Valve

Easily set to desired temperature — The Valve, actuated by room temperature air, maintains temperatures by *modulating* the flow of steam or hot water through the radiation. Self contained — Easily installed without wiring or external connections. Adaptable to low pressure steam and hot water systems — ask for details.

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Sterlco Products Distributed through

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CONDENSATION AND VACUUM PUMPS

HEATING SPECIALTIES

TEMPERATURE CONTROLS

SLANT-FIN

TELLS WHY THIS IS BETTER FINNED PIPE

Improved Design and Construction

IN BOTH "SLANT-FIN" AND "SQUARE-FIN" RADIATORS

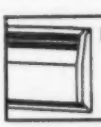
1 **BETTER FIT OF FIN TO PIPE.** With exclusive equipment designed by Slant-Fin engineers, pipe is forced through undersize hole in fins under tons of hydraulic pressure. No weakening of pipe walls by expanding pipe or by fins cutting into pipe surface. The result is the **strongest mechanical union of pipe and fin.**

2 **PERFECT THERMAL BONDING.** On a special machine, standard pipe is rolled to uniform, absolutely round diameter. Wide flanges of fins press solidly against entire surface of pipe for **highest heat transfer efficiency.**

3 **PRECISION SPACING AND EXTRA STRENGTH.** For the flanges of the fins, Slant-Fin devoted much time to experimental engineering. Because of the uniformity of the flanges and their interlocking features, the **fins fit tightly one into another.**

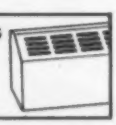
4 **MORE EFFICIENT AIR CIRCULATION.** Because of the increased surface, **fewer** of the distinctive "V" shaped **slant fins** than the traditional square fins can furnish the same radiation per linear foot of pipe. Therefore, fins can be wider apart and a greater volume of air flows more freely.

5 **NO SNAPPING — NO BUCKLING OF FINS.** Because of the **patented notched flange,** the slant-fin can expand and contract without disturbing the bond to the pipe, even under high steam pressures. The result is a radiator that is trouble-free and **noiseless.**



RESIDENTIAL BASEBOARD HEATING

For Steam or Hot Water.
Choice of 3 Heating Elements
and 2 Enclosure Styles.



CATALOG No. 505 gives details on the complete line of "Slant-Fin" and "Square-Fin" radiators and enclosures for commercial and industrial applications. BULLETIN No. R-602 supplies facts about residential baseboard heating. Write for your copy.

SLANT-FIN RADIATOR CORPORATION

87-65 130th Street, Richmond Hill 18, New York

Effective *quiet* duct exhaust with Swartwout Airlift

Centrifugal Fan Type Ventilator

Here's measurable *effective* exhaust capacity at very low noise levels! Quietness alone in duct exhausters isn't enough; you want the capacity needed for the job without wasteful size and cost. Airlift ventilator design features a streamlined fan inlet and oversize outlet opening. Turbulence and friction losses are cut to the minimum. It is often possible to use a smaller size Airlift than ordinarily specified because of the efficiency of both ventilator design and centrifugal fan wheel. The low tip speed of the fan assures quiet operation.

Capacities of the 14 larger Airlift sizes (top illustration) range from 1350 to 32,000 C.F.M.; for Airlift Jr, (left) from 280 to 895 C.F.M. in 4 sizes. Write for Bulletin AL-F.

18568 Euclid Avenue, Cleveland 12, Ohio

The Swartwout Co.

Roof Ventilators and Ventilating Louvers

POWER PLANT EQUIPMENT • PROCESS INDUSTRY CONTROLS

WHO'S WHAT

Continued

▸ *SPORLAN VALVE CO.*—Alan Owens, manager of new Washington, D. C. office; Thor Gislason, a similar appointment for the company's new office at Boston.

▸ *PEERLESS PUMP DIV.*—Robert P. Young, manager of New York district office.

▸ *DONOVAN ASSOC.*—Chester A. Garland, sales engineer covering Boston, Providence, Worcester areas. The company is manufacturers' representative for Acme Industries, Inc. and Kramer-Trenton Co. in New England.

▸ *ARMSTRONG CORK CO.*—M.F. Kottmeier, manager of insulation division district office at Chicago; William J. Appel, district manager at Pittsburgh.

▸ *JOHNSON SERVICE CO.*—Eastern district branch offices have been relocated to expanded quarters. These are: Boston, to 64 Moulton St., Cambridge 38, with J. H. Colby as branch manager; Washington, to 2117 M St., N. W., with W. C. Jones as branch manager; Norfolk, to 4701 Colley Ave., with C. G. Conway as sales engineer in charge. In Philadelphia, a new addition is being added to the office at 2853 N. 12th St. D. S. Plewes is branch manager.

▸ *BLAW-KNOX CO.*—Frederick L. Feldmeth, sales engineer at the Philadelphia office, assisting W. M. Adler.

▸ *SUPERIOR VALVE & FITTINGS CO.*—Raymond J. Talty, midwest district manager.

▸ *KIELEY AND MUELLER, INC.*—Alfred W. Bailey, manager of recently opened New York City offices.

▸ *TRENT TUBE CO.*—W. H. Collins, northeastern district sales manager.

▸ *PENN CONTROLS, INC.*—A. W. Barr, eastern regional sales manager.

▸ *HAMMEL-DAHL CO.*—Paul E. Bowles, district sales manager for new office at Tulsa.

▸ *MORRIS MACHINE WORKS*—Ramsay Pump and Supply Co., to cover western Pennsylvania, eastern Ohio, northern West Virginia; Maleson Co., representative for eastern Pennsylvania.

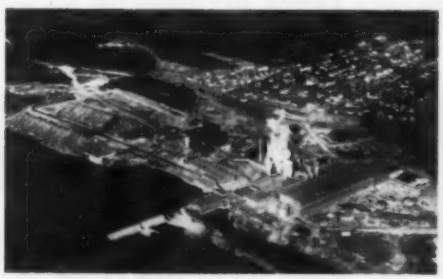
"WITCH"

PIPE HANGERS

FOR

HEATING – PLUMBING POWER & PROCESS

WITCH STANDARD AND SPECIALLY FABRICATED PIPE HANGERS AND SUPPORTS ARE SERVING COMMERCIAL INDUSTRIAL AND INSTITUTIONAL AND PUBLIC BUILDINGS COAST TO COAST



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EAST MILLINOCKET, MAINE

Our catalogue illustrates a *complete* line of Pipe Hangers & Supports and is an indispensable reference book for engineers, contractors, estimators & erectors. Write for your copy now.

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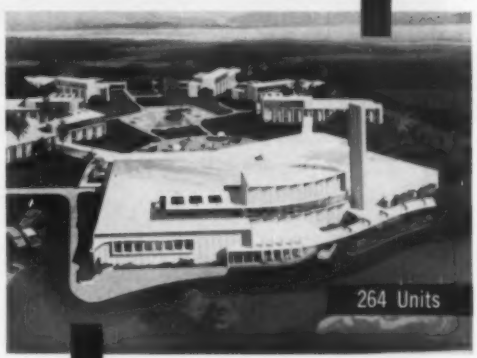
CARPENTER and PATERSON, Inc.

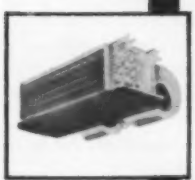
18 HURLEY ST., CAMBRIDGE, MASS.

New! Really Compact!

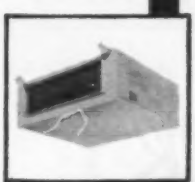
drayer-hanson SPOTAIRE-LRC Air Conditioning



. . . already set for new Lady Luck Hotel, Las Vegas
* rendering courtesy Architect Homer Rissman



LRC Basic Unit



LRC Concealed Cabinet

No individual-room equipment for complete air conditioning of multi-room structures allows such design freedom for the architect . . . achieves such "pin-drop" quietness of operation!

Eye-opening . . . new D-H Spotaire LRC's require just 11½" head-room from ceiling; provide your best answer for low-cost, individual room air conditioning. 3-speed controls. For cooling, heating, dehumidifying, filtering. Old or new construction.

There's also a full LRC story — installation — operation — no-maintenance — you should know about . . .

Request catalog L.P. 5.220

d-h SINCE 1910

drayer-hanson INCORPORATED

3301 Medford Street • Los Angeles 63, California
(Subsidiary of National - U.S. Radiator Corporation)

Need Convertors?

With this bulletin
it's EASY to select the size you want

Here's a reference book specially arranged to help you select and specify Convertors. Right at your finger tips it provides complete information . . . including installation data . . . on our extensive line of Convertors. The tables have been carefully developed for your convenience in determining the right unit quickly. Be sure to get your copy of Bulletin 62 and keep it at hand for reference. Fill in the coupon and mail it today.

The Whitlock Manufacturing Co.
44 South St., West Hartford 10, Connecticut
In Canada: Darling Brothers, Ltd., Montreal

Whitlock

WHITLOCK Designs and builds: bends, coils, condensers, coolers, heat exchangers, heaters, piping, pressure vessels, receivers, reboilers.

The Whitlock Manufacturing Company
West Hartford 10, Conn.

Send me Bulletin No. 62 describing Whitlock Convertors.

Your name ..... *Title* .....

Company name .....

Address .....

.....

WHO'S WHAT — *Continued*

▸ *CHICAGO NIPPLE MFG. CO.*—Macbeth Assoc., representative for New York State, excluding New York City. The territory will also include Erie, Pa.

▸ *WILLIAM WALLACE CO.*—Jack P. Waldrop, assigned to sales staff of Metalbestos Div., to cover western Tennessee, Mississippi, Louisiana.

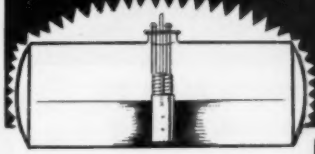
▸ *AUTOMATIC SWITCH CO.*—Distributors and their territories are: Frank A. Blesso, Inc., Hartford; Control Specialty Corp., Houston; Dearing & Co., Youngstown; Industrial Equipment Co. of Houston, Houston; Moody-Price, Inc., Baton-Rouge; Moorlane Co., Amarillo.

▸ *PERFECTION INDUSTRIES DIV., HUPP CORP.*—William Van Hoogenhuyze Co., Inc., distributor for south central Texas; T. J. Kasper, representative for metropolitan New York, northern New Jersey.

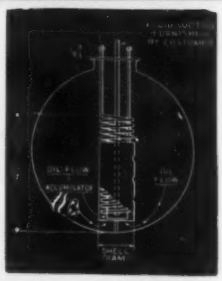
▸ *ROCKWELL MFG. CO.*—Donald C. Morgan, central regional sales manager with offices at Pittsburgh; R. V. Burnette, Chicago district sales manager, succeeding Mr. Morgan. Mr. Morgan fills the position vacated by the retirement of Carl C. Moore. ⫩

PREHEAT HEAVY OILS IN STORAGE TANKS

REMPE "Hot Spot" PREHEATER



Preheats fuel oils and other liquids to proper flow temperature before entering the suction line.



No. 5 and Bunker C oils flow more freely at high temperatures—have greater BTU value. The Rempe "Hot-Spot" does the preheating job efficiently. Takes the load off the suction pump. All-steel construction. Inlet and outlet pipes furnished in required lengths for any diameter tank. Steam or Hot Water can be used as heat source. Made with 14" or 16" diameter shell. Complete facilities for fabrication of pipe coils — all types — all materials. Engineering service. Send details for price.

Write for details and price

HEAT TRANSFER EQUIPMENT REMPE CO. Founded 1890

REMPE COMPANY

342 N. Sacramento Blvd., Chicago 12, Ill.

Shhhhh . . .

COMPLETE *SILENCE*
FOR YOUR ENTIRE

PIPING SYSTEM

WITH A

MILLER *STREAMFLOW* CHECK VALVE

CENTER GUIDED • SHOCK PROOF • ELIMINATES WATER HAMMER
ENTIRELY *NOISELESS* • FULL RADIAL FLOW
Certified Minimum Pressure Loss Curves Available • Sizes 1" through 24" Flanged • ASA Drilling • IBBM • Cast Steel • All Alloys

WRITE FOR LATEST CATALOG
AGENTS IN PRINCIPAL CITIES **MILLER VALVE CO.** INC.
P.O. BOX 1255 — PITTSBURGH 30, PA.
PLANT — 1620 PENNSYLANIA AVE.

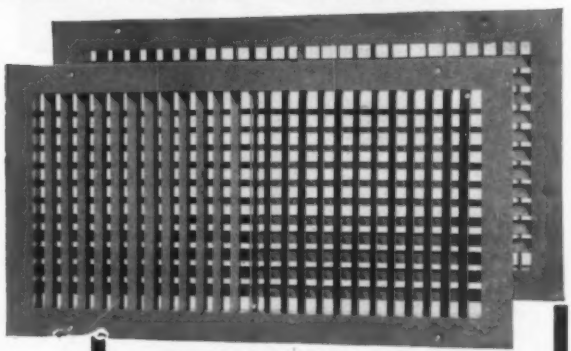
See This Sensational New Heating & Ventilating

GRILLE WITH DETACHABLE VOLUME CONTROL!

- **Increased Directional Control**
- **Eliminates Possibility of Tampering or Accidental Changes**
- **Meters Air-flow Accurately**

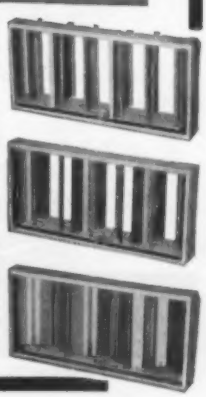
A-J

New features never before available . . . increase directional control, tamper-proof regulating, unmatched beauty, rugged strength and extreme ease of installation.
Extruded aluminum vanes are individually adjustable. Their unique shape provides greater directional control, and reduces air resistance to a minimum. This means more accurate balancing.
Each vane individually controlled. Operates under spring-loaded tension, eliminating any possibility of deflection pattern being altered by accident or tampering.
Fully-enclosed, wrap-around frame makes grille sturdier, assures easier, safer installation. Entire mechanism is concealed eliminating possibility of "air leaks".
Series "400" A-J Grilles (with — or without volume control) available in any size. Choice of vertical or horizontal louvers only — or combination of both, with either louver in front. Both sets of louvers adjustable without removing grille. Available in prime coat, hammered bronze or metallic gray or any standard finish.



NEW DETACHABLE VOLUME CONTROL

Easy to operate. Accurately meters air-flow from a "Whisper" to a "Full Blast"! A volume control you can depend on! Meters the flow accurately at *every stage* — from fully closed to fully open. No "dead spots". Louvers move simultaneously in opposing directions. Gear-driven action. System may be balanced without removing outer grille. Available with grille, or can be quickly installed later.



For More Information — Call or Write

A-J MANUFACTURING CO.

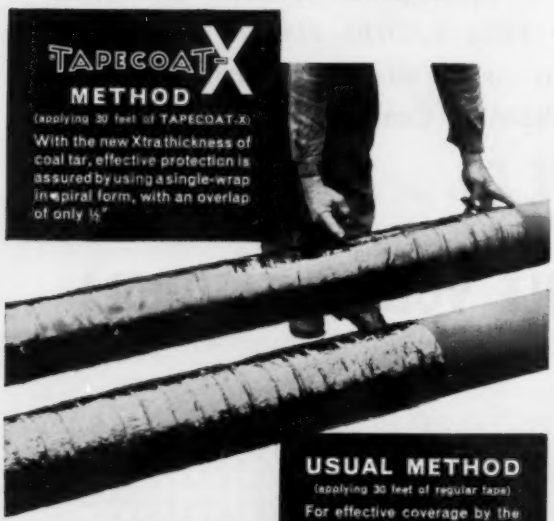
3601 E. 18th St. Dept. H-11 Kansas City 27, Mo.

Matching Return Air Grilles Available

For XTRA COVERAGE

Specify TAPECOAT-X

... the time-tested quality coal tar coating in tape form ... now made with Xtra thickness of coal tar to go farther, faster *on pipe, pipe joints, fittings, mechanical couplings, tanks and other surfaces vulnerable to corrosion.*


TAPECOAT-X
METHOD
(applying 30 feet of TAPECOAT-X)
With the new Xtra thickness of coal tar, effective protection is assured by using a single-wrap in spiral form, with an overlap of only ½"
USUAL METHOD
(applying 30 feet of regular tape)
For effective coverage by the usual double-wrap method, it is necessary to overlap the tape slightly more than half its width.

See how the Xtra thickness of coal tar built into TAPECOAT-X provides extra protection per foot of tape. This extra thickness of coal tar, made possible by a new exclusive process, permits a single-wrap application that can be applied faster and over a greater area for savings in labor, material, time and money.

These and other practical advantages make it worth your while to get the complete details on TAPECOAT-X.

Write for literature today

The TAPECOAT Company
ORIGINATORS OF COAL TAR COATING IN TAPE FORM
1555 Lyons St., Evanston, Illinois

WE HEAR THAT...

▸ *ARMCO STEEL CORP.* is stepping up its 1955 expansion and improvement program. According to *W. W. SEBALD*, president, the company's board of directors had approved an increase in the 1955 program from $60 million announced earlier this year to $111 million. The program also calls for the addition of 1,176,000 tons of steel to Armco's present 4,950,000 ton capacity—an increase of nearly 25 percent.

▸ *TRIANGLE EQUIPMENT CO., INC.*, Chicago, has relocated to 610 W. Van Buren St. in that city. Triangle serves as Chicago sales office for *D. J. MURRAY MFG. CO.*

▸ *LADISH CO.* has announced the purchase of two adjacent Los Angeles manufacturing plants, *CBS STEEL AND FORGE CO.* and *GENERAL PACIFIC CORP.* The plants will operate as the Ladish Pacific Div. *J. L. VARGA* will manage the new facility.

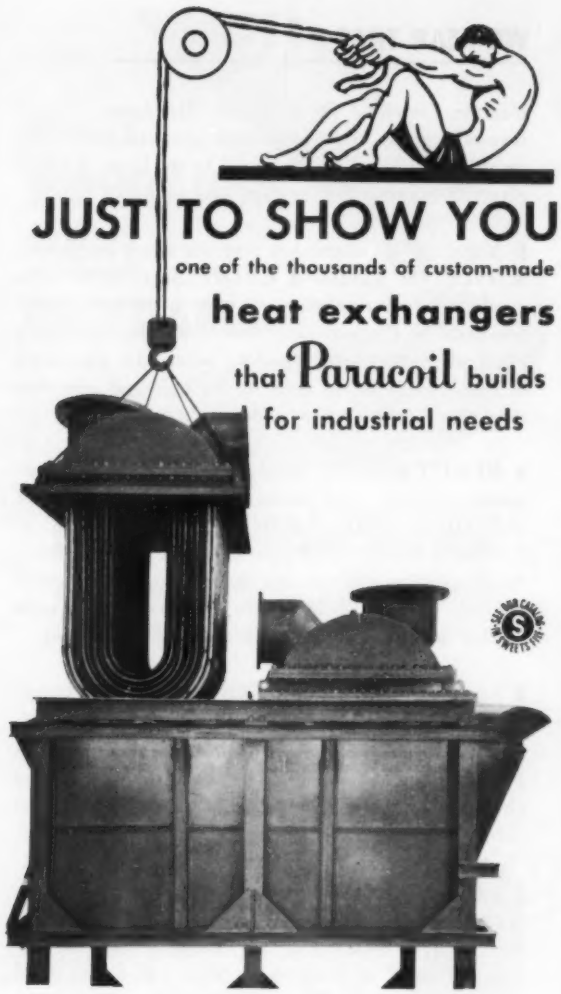
▸ "Portable Parade" is the title of a new, sound movie in full color recently produced by the *OSTER MFG. CO.* The film deals with the proper selection and use of portable pipe threading machines, both in the shops and on the job. The company announces that it is available free, on a loan basis.

▸ Construction will be started shortly on an administration and engineering research building at Indianapolis as the national headquarters of the *BRYANT DIV.* of *CARRIER CORP.* The structure is scheduled for occupancy by July of next year.

▸ *UNION MALLEABLE MFG. CO's* new foundry at Ashland, Ohio has been completed. Of cement, steel and glass construction, the structure contains 47,000 sq ft of floor space. This is the first phase of the company's $8 million plant expansion program. The second phase, still in the planning stage, is a 55,000 sq ft building to house the company's electric annealing and automatic galvanizing operation and machine shop facilities. Construction will begin in 1956.

▸ Recognizing the ever increasing need for technically trained engineers, *GARDNER-DENVER CO.* has announced the establishment of an engineering scholarship fund. An expansion in the company's program for the furtherance of higher education, scholarship grants are given to schools which are leaders in their specific fields. Student selection, in turn, is made by the schools.

▸ *PERFECTION INDUSTRIES DIV.* of the *HUPP CORP.* has sold its six story Platt Ave. manufacturing



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one of the thousands of custom-made

heat exchangers

that Paracoil builds

for industrial needs

A 13,000 cfm direct-fired air preheater being assembled at our Elizabeth plant. The stainless steel combustion chamber (not shown) sets below the tube banks. Air exit temperature 1000° F.

OUR EXPERIENCED ENGINEERS are available to expedite planning and specification work and to suggest the most suitable and economical exchanger design.

MODERN MANUFACTURING facilities and advanced techniques, skilled and seasoned shop personnel guarantee fabrication to rigid specifications.

FAST DELIVERY is assured by efficient shop work and immediate transportation facilities.

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CORPORATION

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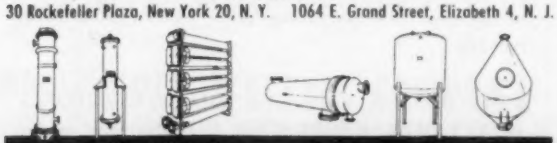

Paracoil's skill to do comes of doing . . . Since 1915

NEW Randall BEARING BRACKET

A sturdy, compact, 10-gauge steel bracket bearing, furnished completely assembled ready to mount, or knocked down, as desired. It features the RANDALL "Deep Well" graphited ball assembly contained in a spherical rubber cushion to assure maximum absorption of vibration, quiet operation, and constant controlled self-alignment.

This bracket retains all the outstanding qualities that the name RANDALL implies —sturdy, low cost, quiet operation, easy installation, constant self-alignment, double lubrication, and long life. Furnished in standard shaft sizes, $\frac{5}{8}$", $\frac{3}{4}$", $\frac{15}{16}$", and 1" inclusive. Shaft sizes $\frac{1}{2}$", $\frac{13}{16}$" and $\frac{7}{8}$" can be furnished on special orders in production quantities.

Write today for additional information, or ask your area distributor to show you Randall's complete line.

BRONZE BAR STOCK
BRONZE BUSHINGS
PILLOW BLOCKS
SHEET LUBRICATOR

Randall

GRAPHITED BEARINGS
THRUST WASHERS
SAFETY COLLARS
BRONZE CASTING

RANDALL GRAPHITE BEARINGS, INC.

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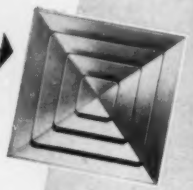
air patterns unlimited without blank-offs

AGITAIR® Custom Made

AIR DIFFUSERS with DIFFUSING VANES

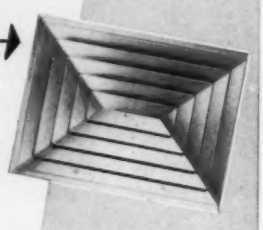
. . . better because

A good piece of equipment is no better than the experience behind it.



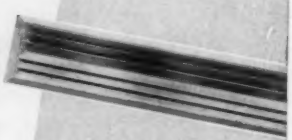
. . . better because

It's the original square and rectangular outlet . . . not just a poor imitation without distinctive features.



. . . better because

The company behind these diffusers has a history for doing things right and guaranteeing results.



you can depend on AGITAIR for better air

Your local AGITAIR representative will gladly assist you in selecting the proper size and air pattern to meet the requirements of your job. In addition, the engineering staff and laboratory resources of Air Devices Inc., are available to you.

AIR DEVICES INC.

185 MADISON AVENUE NEW YORK 16, N. Y.

Air Diffusers • Filters • Exhausters

WE HEAR THAT

Continued

plant in Cleveland for $600,000. The buyer was an investors group. Perfection will gradually move its records, facilities and personnel to its large, modern plant on Ivanhoe Rd. in that city.

▸ A $90 million expansion program involving five of *KAISER ALUMINUM & CHEMICAL CORP.'s* principal manufacturing plants is now underway. Major emphasis in the program centers on the company's plant at Ravenswood, W. Va., where an additional $75 million is being spent to enlarge and complete the initial facilities now under construction.

▸ *HEWITT-ROBINS, INC.* has acquired manufacturing facilities and assets of the *W. A. JONES FOUNDRY AND MACHINE CO.* According to *THOMAS ROBINS, JR.*, president of Hewitt-Robins, the acquisition will enhance the company's position in the belt conveyor field, where drive equipment such as that made by Jones is an essential component.

▸ Eight awards in *DRAVO CORP.'s* annual $12,000 college and university scholarship program for 1955-56 have been made. Awards to students are based primarily on scholarship, leadership and personal characteristics which indicate potential capacity to succeed.

▸ *L.O.F GLASS FIBERS CO.* has announced plans for a new research center within the company's research department. The new building will be the "nerve center" of research facilities which now total over 32,000 sq ft. These are located at Waterville, Ohio.

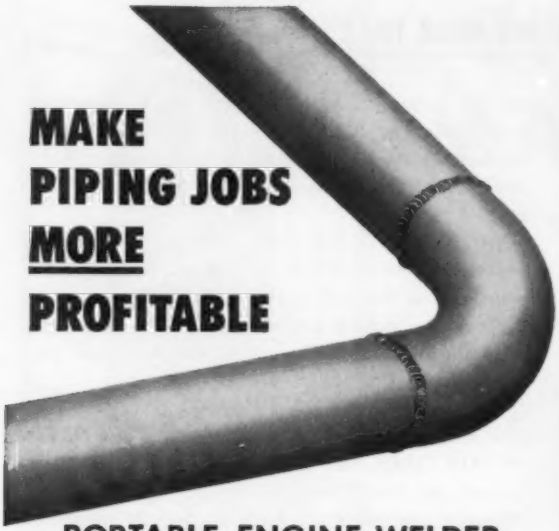
▸ *O. C. KECKLEY CO.* has moved to its new location at 3400 Cleveland St., Skokie, Ill. The new and modern plant combines the general offices and manufacturing facilities of the company. The structure is a one story brick with a total of 80,000 sq ft of floor space. The general office is air conditioned throughout.

▸ *ROCKWELL MFG. CO.* will soon begin construction of a 100,000 sq ft warehouse, assembly and repair plant at Porterville, Calif. Company officials estimate the plant, expected to be completed by early 1956, will cost approximately $1 million.

▸ *McQUAY, INC.* has announced the formal opening of its new manufacturing plant at Grenada, Miss. recently.

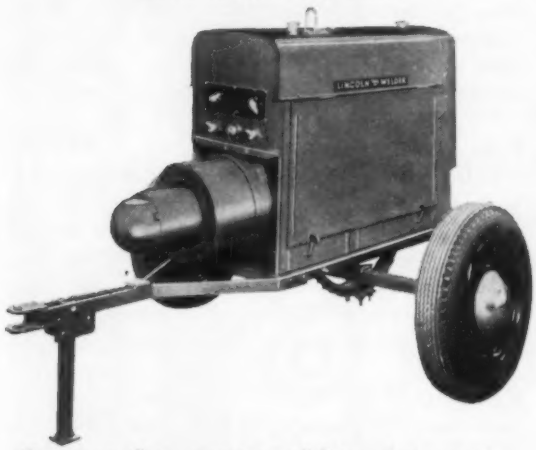
▸ For the sixth consecutive year *MINNEAPOLIS-HONEYWELL REGULATOR CO.* has won a top award in the "Best of Direct Mail Advertising" com-

MAKE PIPING JOBS MORE PROFITABLE



PORTABLE ENGINE WELDER

eliminates costly long cables and hook-up time



Best arc for every position—flat, vertical, overhead is instantly selected on "Shield-Arc's" Dual Control.

Peak performance at lowest cost—engine idling device saves fuel, cuts down on maintenance.

Compact, easy to move around—mounted on rubber-tired undercarriage.

Information on Complete Line—Lincoln gasoline and diesel-engine driven welders described in Bulletin 1337. Write for it.

THE LINCOLN ELECTRIC COMPANY

Dept. 3806 • Cleveland 17, Ohio

The World's Largest Manufacturer of Arc Welding Equipment

MERCOID®

PRESSURE CONTROLS

FOR OUTDOOR SERVICE

HERE'S ANOTHER MERCOID PRODUCT DESIGNED TO OUTPERFORM AND OUTLAST ORDINARY TYPES OF PRESSURE CONTROLS.

Conforms to Nema specifications 1A (semi-dust tight), 2 (drip tight), 3 (weather resistant, weather proof, splash proof, sleet proof, moisture resistant and rain tight), 4 water tight (hose test).

The case and cover are zinc plated steel having a coating that will withstand a 50-hour salt spray test. The cover provides for visible inspection of the sealed Mercoid mercury contact and the calibrated dial. Adjustments are external. Electrical connection is made by means of a ½-inch tapered pipe protruding back of control case.

IT'S AVAILABLE IN

17 DIFFERENT PRESSURE RANGES FROM 0-30" VAC. TO 300-2500 P.S.I.

WITH THE SENSITIVITY YOUR APPLICATION REQUIRES

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THE MERCOID CORPORATION

4201 BELMONT AVE., CHICAGO 41, ILLINOIS

New York: 205 E. 42nd Street • Philadelphia: 3137 N. Broad Street

Experience has taught the Universal Diffuser Corporation that the Alnor Velometer minimizes time required to balance an installation of Flexiflo diffusers. They *recommend* the Alnor Velometer because they know it consistently measures *actual* air flow precisely and quickly.

The Velometer is the *only* instantaneous, direct reading air velocity meter—accurate in all ranges, from high to low—compact, portable, easy to understand and use. Wide assortment of jets and fittings makes this precision instrument ideally suited for all air velocity measurement.

Get an Alnor Velometer for your air measurement needs. You'll save time and money wasted in balancing air distribution on your *next* installation. If you'd like a copy of Universal's instructions on balancing Flexiflo Diffusers with the Velometer, just send the coupon below.

Alnor **ILLINOIS TESTING LABORATORIES, INC.**
Precision Instruments for Every Industry

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Room 513, 420 N. LaSalle St.
Chicago 10, Illinois
☐ Send Flexiflo Installation Manual
☐ Send Velometer Bulletin 2448

Name.....
Company.....
Address.....
City.....Zone.....State.....

WE HEAR THAT

Continued

petition sponsored by the Direct Mail Advertising Association. The award was given specifically for the company's promotion in behalf of its electronic "Moduflow" control system during 1955.

▸ *HAGAN CORP.* will build a $1 million chemical processing plant at Rockwood, Mich. Scheduled for completion in the Fall of 1956, the plant will process and package various products used for conditioning water for commercial, industrial and municipal purposes.

▸ To accommodate the expansion program of *WORTHINGTON CORP.'s* air conditioning and refrigeration division, the division will shortly move into new home office and manufacturing facilities recently purchased in East Orange, N.J. This new plant will be known as the Ampere Works.

▸ *PITTSBURGH PLATE GLASS CO.* has disclosed plans for the construction of a multimillion dollar window glass producing plant at Decatur, Ill. The new plant will be located on an 80 acre site southeast of the city. About 250 employees will operate the facility.

▸ An annual award, directed by the *AMERICAN WELDING SOCIETY* and sponsored by *A. F. DAVIS,* vice president and secretary of the *LINCOLN ELECTRIC CO.,* has been presented for the best student paper on welding to appear in an undergraduate publication during the school year ending last June. A student at Georgia Institute of Technology is recipient for his article, *Welding Faces Automation.*

▸ *VIKING INSTRUMENTS, INC.* plans to double the plant and production facilities of its recent acquisition, *ECONO PRODUCTS CO.* The additions, to be built on the company's present site, will be devoted to the manufacture of hot water circulators, low water cutoffs and other heating specialties.

▸ *LEON SMYLIE* of *SMYLIE BROS. REFRIGERATION, INC.* is the winner of a "Weathermaker Hall of Fame" award from *CARRIER CORP.* as the outstanding Carrier packaged air conditioner salesman in the corporation's Cleveland branch. *DAN R. WILLIS* of the *DAN H. WILLIS CO.,* Akron, was cited as the top wholesale salesman for the Cleveland branch which includes Akron. Awards were based on results in a sales contest.

▸ *CRANE CO.* was hailed recently by Chicago business and industry for outstanding leadership during its 100 years of operation. The tribute was a testimonial resolution adopted by the board of directors of the Chicago Association of Commerce and Industry.

FOR MORE DETAILED INFORMATION WRITE FOR BULLETIN W-2A and W-10.

GOLDEN ANDERSON Valve Specialty Company

1210 RIDGE AVE., PITTSBURGH 33, PA.
Designers and Manufacturers of VALVES FOR AUTOMATION

SHOCK TAMER TWINS

These two automatic cushioned valves will prevent the hammer and shock normally caused by surges in the system.

G-A ELECTRIC CHECK VALVE

G-A SURGE RELIEF VALVE

ENDS MAINTENANCE

in general pump service

Single-stage, double suction DMV-DHV general hydraulic pumps are available for heads to 350 ft., capacities from 275 to 2400 gpm.

Double shaft seals and sealed ball bearings—standard equipment on **DMV— DHV** *pumps do away with stuffing box attention and bearing lubrication*

Now, with the DMV-DHV pump, you no longer have any stuffing box worries. There's no repacking! No annoying pump shaft leaks! The Double Mechanical Shaft Seals used are completely self-adjusting. They don't require attention throughout their entire service life.

Moreover, greasing or oiling of pump bearings is done away with. Modern Cartridge-Type Ball Bearings are employed—with the lubricant permanently sealed in. Here's another advanced feature that makes the DMV-DHV design the simplest, most maintenance-free pump ever developed by Ingersoll-Rand for general hydraulic service.

Greater Compactness is obtained with this modern construction using mechanical shaft seals and sealed bearings.

See your nearest Ingersoll-Rand representative for further information.

Ingersoll-Rand

10-290

Cameron Pump Division
11 Broadway, New York 4, N. Y.

PUMPS • CONDENSERS • TURBO-BLOWERS • COMPRESSORS • ROCK DRILLS
GAS & DIESEL ENGINES • AIR & ELECTRIC TOOLS

One of three Goulds Fig. 3750 pumps circulating chilled water in air conditioning system in big color processing building of Eastman Kodak Company, Rochester, N. Y.

They help keep roses red and violets blue

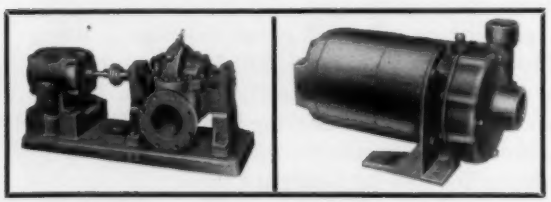
Processing color photographs requires extremely close control of temperature at all stages.

In the big color film and print processing building in Kodak Park, in Rochester, N. Y., three Goulds pumps like the one shown above help maintain the correct temperature by circulating 50° water through heat exchangers serving process work rooms.

The critical nature of the process means that these pumps must stay on the job 24 hours a day—day in and day out—and these Goulds pumps have been doing just that for the last two years.

You can insure the same kind of dependable pump performance in your air conditioning installations, too, by specifying Goulds pumps. There's a Goulds pump for every liquid handling job—designed from the experience gained over a century of pump manufacture, and ruggedly built to give long, trouble free service.

Your Goulds representative will be glad to help you select the right pumps to fit your requirements. If you prefer to write directly to our main office, your inquiry will receive prompt attention.



Goulds popular "close-cupld" Fig. 3642 and Fig. 3643 pumps provide compact efficiency, simplicity in small installations. In sizes from ¼ to 5 HP. Capacities up to 175 GPM, and heads to 140 ft. For additional details write for Bulletin 624-A.3.

Goulds Fig. 3405 double suction pump offers many advantages for larger installations. Available in 19 sizes, providing capacities up to 6,400 GPM, heads to 260 ft. For full details write for Bulletin 721.6.

MEMBER

Goulds PUMPS INC. Seneca Falls New York

Atlanta • Boston • Chicago • Houston • New York • Philadelphia • Pittsburg • Tulsa

MEETINGS & CONVENTIONS

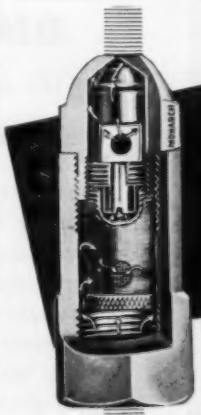
NOV. 9-11—*Institute of Boiler and Radiator Manufacturers,* Fall meeting. Absecon, N. J. I=B=R headquarters: 608 Fifth Ave., New York 20.

NOV. 14-17—*2nd International Automation Exposition.* Navy Pier, Chicago. Management: Richard Rimbach Assoc., 845 Ridge Ave., Pittsburgh 12.

NOV. 14-18—*Chicago Exposition of Power & Mechanical Engineering.* Coliseum, Chicago. The exposition is being held in conjunction with the 75th Anniversary Meeting of the American Society of Mechanical Engineers, November 13-18, at the Congress, Conrad Hilton and Sheraton-Blackstone Hotels in that city. Management: International Exposition Co., Inc., 480 Lexington Ave., New York 17.

NOV. 16-17—*Industrial Hygiene Foundation,* 20th annual meeting. Mellon Institute, Pittsburgh. The Foundation is at Mellon Institute, 4400 Fifth Ave., Pittsburgh 13.

NOV. 26-28—*Refrigeration and Air Conditioning Contractors Association National,* 10th annual convention. Ambassador Hotel, Atlantic City. RACCA headquarters: 10660 Carnegie Ave., Cleveland 6.



Monarch NOZZLES For HUMIDIFYING

Monarch Brass F-80 Air Conditioning Nozzles (or ¼" male one-piece H-261 style) produce the finest possible breakup of small capacities with low direct pressure only. No air required.

The most popular size is #3.00 which operates on as little as 25 pounds pressure, delivers 1.00 gph and produces a very wide angle of spray (120°) in a fine, soft, fog-like mist.

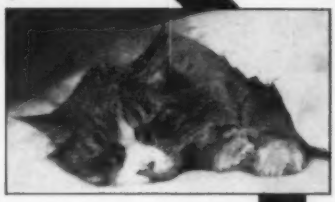
Available in 25 different capacity sizes from .57 gph upwards, all Brass construction with 120 mesh Monel screen strainers.

WRITE FOR CATALOG 6-A

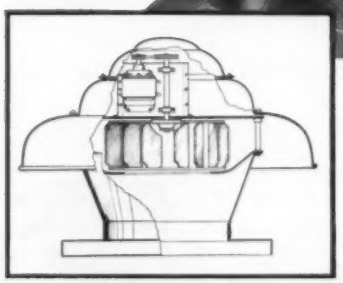
Monarch MFG. WORKS, INC.
2523 E. ONTARIO ST.
PHILADELPHIA 34, PA.

Canadian Agents: (Except B.C.)
Canadian General Filters Ltd., Toronto 16, Canada

install kitten-quiet
VENTILATION



Specify the
PENN
DOMEX



Low velocities and low rotational speeds are combined in the Domex to provide the hushed air movement so necessary in modern building ventilation.

V-Belt driven centrifugal fans in attractive and ageless spun aluminum housings permit capacity selections from 400 to 4000 cfm. This also permits standardization of roof openings and provides a uniformity of appearance and height for all roof mounted fans through this wide range of capacities.

The Penn Ventilator man in your area has complete data on these versatile exhausters as well as the other powered and gravity ventilators in Penn's complete line.

Complete Literature Available Write to Engineering Department

PENN VENTILATOR COMPANY

Representatives and Distributors in principal cities

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In Eastern Canada: **Air-Care, Ltd.**
2125 Marcil Ave., Montreal 28, Que.

Member of the Power Fan Manufacturers Association

FOR MORE THAN 25 YEARS THE BUILDERS' TOP LINE

Savings from only 2 Paid for All 85

Astounding but true!

Read the facts on

Walker

"BB" Industrial Draft Controls

In the Fairmac Corporation Housing Development near Washington, D.C., replacement of existing "controls" with Walker "BB" Draft Regulators reduced fuel consumption in two boiler houses to such an extent that the cash savings actually paid for complete installation of all 85 Walker draft units! These fuel savings were accomplished in only *three months time*—and they were so spectacular that the April, 1953 issue of *Fueloil & Oilheat* devoted its lead article to a report of the complete details of the story! Reprints of this article are available upon request.

Walker "BB" Industrial Draft Controls can bring you the same kind of savings that the Fairmac Corporation is enjoying. Find out how by reading Walker's "Handbook of Draft Control for Industrial Installations." It gives the most complete facts ever assembled on control selection, proper location, capacities, installation and adjustment. This valuable handbook is absolutely free — and your request for a copy puts you under no obligation. Reserve your copy now—just send coupon below to:

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MANUFACTURING & SALES CO.
1720 Penn St., St. Joseph, Mo.

Gentlemen: I want the complete story on how Walker "BB" Industrial Draft Controls can cut my fuel costs. Please send me your free handbook on "Draft Control for Industrial Installations." I'm considering draft control installations on:

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Company.....

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- Office Building ☐
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- Theater ☐
- Store ☐
- Factory ☐
- Laundry ☐
- Garage ☐
- Other _____

Install BUILDERS SHUNTFLO STEAM METERS right in your steam lines. Keep track of steam costs by seeing where steam is going and how much. Shuntflo Meters available in Model SMKS (shown) for 2" to 14" lines — Model SMDH for 1" and 1½" lines. Write for Shuntflo Bulletins. Builders-Providence, Inc. (Division of B-I-F Industries, Inc.), 381 Harris Ave., Providence 1, R. I.

BUILDERS-PROVIDENCE
DIVISION OF B-I-F INDUSTRIES, INC.
METERS FEEDERS CONTROLS

MEETINGS & CONVENTIONS

Continued

NOV. 26-28—*Air-Conditioning and Refrigeration Wholesalers*, 20th anniversary annual meeting. Claridge Hotel, Atlantic City. Headquarters: 2607 N. High St., Columbus, Ohio.

NOV. 26-29—*Refrigeration Service Engineers Society*, 18th annual convention. Ambassador Hotel, Atlantic City. RSES headquarters: 433 N. Waller Ave., Chicago 44.

NOV. 27-29—*National Heating and Airconditioning Wholesalers, Inc.*, national convention. Governor Clinton Hotel, New York. NHAW headquarters: 1200 W. Fifth Ave., Columbus 12, Ohio.

NOV. 28-*DEC.* 1—*9th Exposition of the Air Conditioning and Refrigeration Industry*. Auditorium, Atlantic City. The exposition is sponsored by the Air Conditioning and Refrigeration Institute, 1346 Connecticut Ave., N. W., Washington, D. C.

NOV. 30-*DEC.* 1—*National Warm Air Heating and Air Conditioning Association*, 42nd annual convention. Hotel Statler, New York. The Association is at 640 Engineers Bldg., Cleveland 14.

DEC. 1-3—*American Society of Refrigerating Engi-*

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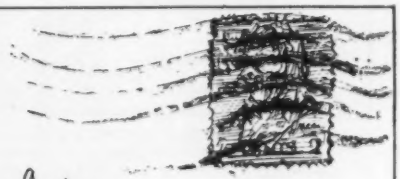

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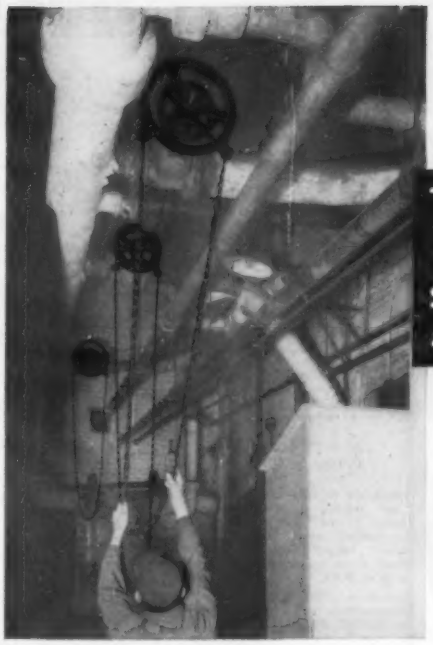
American Cancer Society



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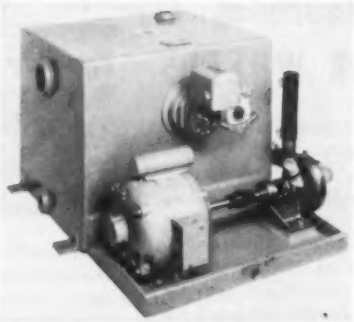

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MEETINGS & CONVENTIONS

Continued

neers, 51st annual meeting. Traymore Hotel, Atlantic City. R. C. Cross, secretary, 234 Fifth Ave., New York.

Dec. 5-9—*25th Exposition of Chemical Industries.* Commercial Museum and Convention Hall, Philadelphia. Management: International Exposition Co., 480 Lexington Ave., New York 17.

DEC. 10-17—*Nuclear Congress and Atomic Exposition.* Municipal Auditorium, Cleveland. American Institute of Chemical Engineers is the sponsor. Exposition director: Athel F. Denham, Atomic Exposition. 931 Book Bldg., Detroit 26. Concurrently will be held the *Nuclear Engineering and Science Congress*, December 12-16. Engineers Joint Council, 29 W. 39th St., New York 18.

JAN. 23-25—*American Society of Heating and Air-Conditioning Engineers, Inc.*, annual meeting. Sheraton-Gibson Hotel, Cincinnati. ASHAE headquarters: 62 Worth St., New York 13.

JAN. 23-26—*7th National Plant Maintenance & Engineering Show.* Convention Hall, Philadelphia. Management: Clapp & Poliak, Inc., 341 Madison Ave., New York 17.

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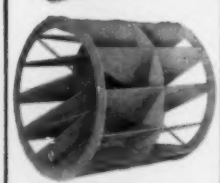

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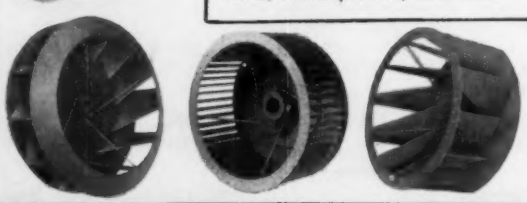

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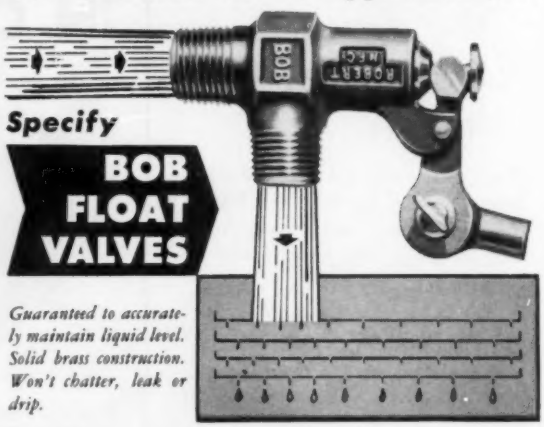

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These standard pumps have characteristics that make them highly efficient for air conditioning service.

Fig. 4350 Series

"MOTOR-MOUNT" Centrifugal Pump. Designed to permit mounting on any motor having "NEMA" type "C" mounting flange. Capacities range to 200 G.P.M.

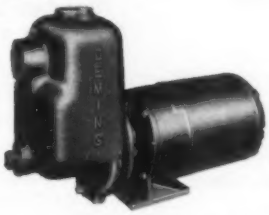

Fig. 3350 Series

Self-Priming type of "MOTOR-MOUNT" Centrifugal Pump. Priming is rapid, automatic, and foolproof. Non-siphoning feature. Capacities range to 140 G.P.M.

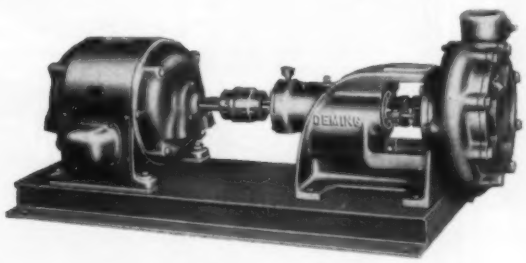

Fig. 4011 Series

These end suction centrifugal pumps are ideally suited for air conditioning service. 4-piece liquid end assembly permits easy service and maintenance. Two ball bearings supporting the shaft are mounted on heavy duty, streamlined support head. Many other top quality features. Capacities range to 1,000 G.P.M.

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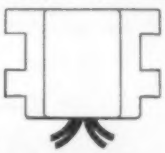

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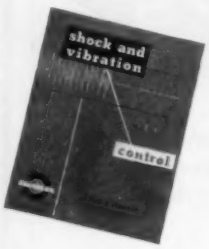

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FEB. 15-17—*Seventh Annual Corrosion Short Course for Pipeliners.* Mayo Hotel, Tulsa, Okla. Sponsored by Tulsa section, National Association of Corrosion Engineers. General chairman: James C. Bell, 119 W. Eighth St., Tulsa.

MARCH 21-23—*18th Annual American Power Conference.* Hotel Sherman, Chicago. Sponsored by Illinois Institute of Technology, 35 W. 33rd St., Chicago 16.

JUNE 18-20—*American Society of Heating and Air-Conditioning Engineers, Inc.,* semi-annual meeting. Shoreham Hotel, Washington, D.C. ASHAE headquarters: 62 Worth St., New York 13.

FEB. 25-*MAR.* 1, 1957—*International Heating & Air-Conditioning Exposition.* International Ampitheater, Chicago. Under auspices of the American Society of Heating and Air-Conditioning Engineers. Management: International Exposition Co., 480 Lexington Ave., New York 17. ‡

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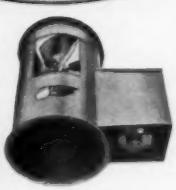

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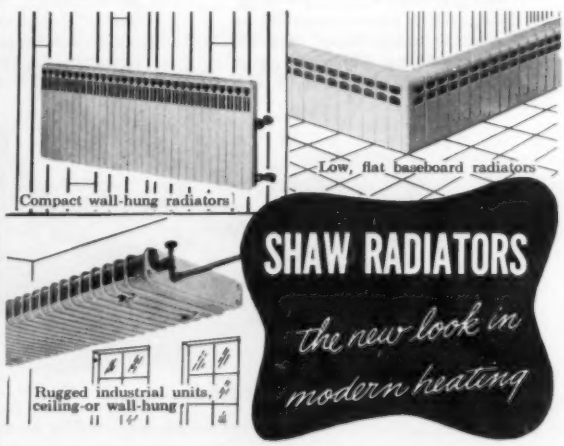

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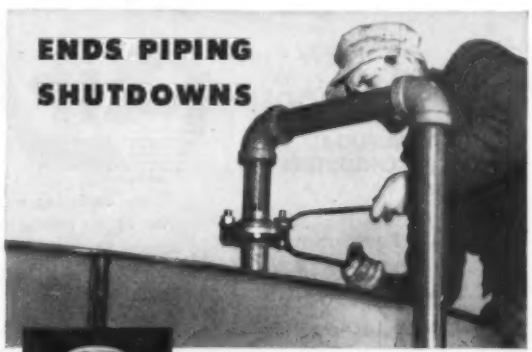

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PRINCIPLES OF NUCLEAR REACTOR ENGINEERING—By Dr. Samuel Glasstone. 872 pp. D. Van Nostrand Co., Inc., 250 Fourth Ave., New York. $7.95.

THE ESTIMATION OF HEALTH HAZARDS FROM AIR POLLUTION—By W. C. L. Hemeon. 6 pp. Industrial Hygiene Foundation of America, Inc., Mellon Institute, 4400 Fifth Ave., Pittsburgh 13. Free.

STANDARDS FOR THE INSTALLATION OF AIR CONDITIONING AND VENTILATING SYSTEMS OF OTHER THAN RESIDENCE TYPE—Publication NBFU No. 90A. 20 pp. National Board of Fire Underwriters, 85 John St., New York 38.

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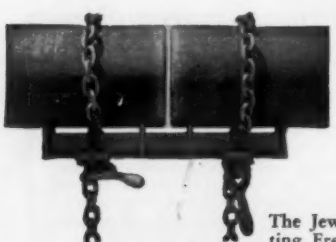

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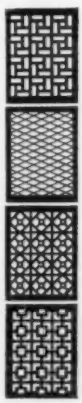

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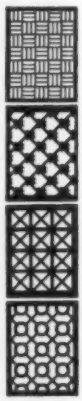

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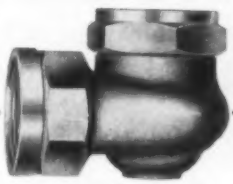

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for October 1, 1955

The following is a statement of ownership, management, etc., as required by the act of Congress of August 24, 1912, as amended by the acts of March 3, 1933 and July 2, 1946 (Title 39, United States Code, Section 233) of Heating, Piping & Air Conditioning, published monthly at Chicago, Ill., for October 1, 1955:

1. The names and addresses of the publisher, editorial director, editor, and business manager are:
Publisher, F. P. Keeney, Chicago, Illinois.
Editorial Director, C. M. Burnam, Jr., Chicago, Illinois.
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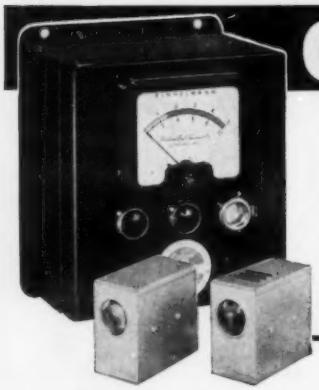

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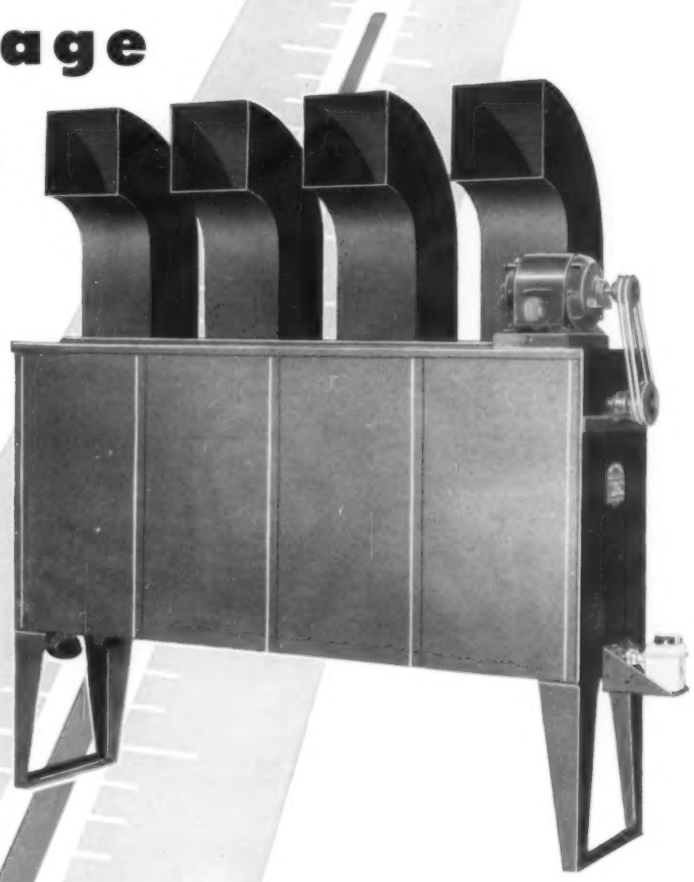

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GREENVILLE MILLS* gets PRECISION REGULATION of TEMPERATURE AND HUMIDITY with JOHNSON CONTROL

From this control panel in a typical processing area, a Johnson Record-O-Stat maintains and records constant wet and dry bulb temperatures. Water bottle, blower and motor are mounted below the Record-O-Stat. The air conditioning system at Greenville Mills is estimated to be the largest in Mississippi.

From raw wool to finished carpets—that's the story of the new Greenville Mills plant of Alexander Smith, Inc. Closely controlled temperatures and humidities, both for worker comfort and to safeguard sensitive processes, are essential to the efficiency of this modern plant. To maintain the exact conditions required in each area of the building, Greenville Mills depends on a specially designed system of Johnson Control. Here's how it works:

PROCESSING AREAS

Processing areas are divided into eight zones—carding, spinning, twisting, reverse twisting, setting and threading, weaving (2), and finishing. Conditioned air is supplied by from one to four air handling units per zone. Accurately controlling the temperature and humidity in each zone is a Johnson T-1020 Two-Pen Record-O-Stat which maintains and records constant wet and dry bulb temperatures.

Each Record-O-Stat operates a Johnson Three-Way Mixing Valve on the chilled water coils, Johnson V-103 Steam Valves on the steam reheat coils, and a Johnson V-105 Steam Valve on the grid humidifier on each of the air handling units. To insure accurate response under all conditions, all valves are equipped with Johnson V-510 Pilot Positioners.

For quick warm-up, hot water can be circulated through the cooling coils. A single, convenient switch provides the changeover.

SMOKE CONTROL FEATURE

A system of smoke dispersal is necessary in this windowless building. If smoke is detected in any unit, the return air damper automatically closes and the maximum outdoor air damper opens, increasing pressure inside the building and forcing the smoke out gravity roof ventilators. A manual switch at each control station will provide 100 per cent outdoor air at anytime.

OFFICES

Ideal temperatures in offices and other comfort areas are maintained by Johnson Individual Room Thermostats which regulate the supply of conditioned air from multi-zone air conditioning units. During the heating season, Johnson Master-Submaster Control automatically varies the heat supply in accordance with outdoor temperature.

OTHER SPACES

Other areas controlled include the laboratories, where control arrangements are similar to those in the processing sections. In the loading and stocking areas, strategically located Johnson Room Thermostats provide the desired temperatures by controlling Johnson Valves on ceiling-hung steam heating units.

Tens of thousands of buildings, of all types and sizes, depend on Johnson Control for the precision regulation of temperatures and humidities. In every case, simple or complex, the Johnson System is specifically designed to fit the exact needs of the individual building. Next time you have a problem, ask a nearby Johnson engineer for recommendations. There is no obligation. JOHNSON SERVICE COMPANY, Milwaukee 2, Wisconsin. Direct Branch Offices in Principal Cities.

*Greenville Mills, Inc., Greenville, Miss. (a division of Alexander Smith, Inc.). Mallett & Associates, architects and engineers, Jackson, Miss.; James F. O'Neil Co., heating and air conditioning contractor, New Orleans, La.

JOHNSON CONTROL

TEMPERATURE ↕ AIR CONDITIONING

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